the OIL AND GAS JOURNAL
FEBRUARY 17, 1958

JOURNAL REPORT

How Refiners are Combating

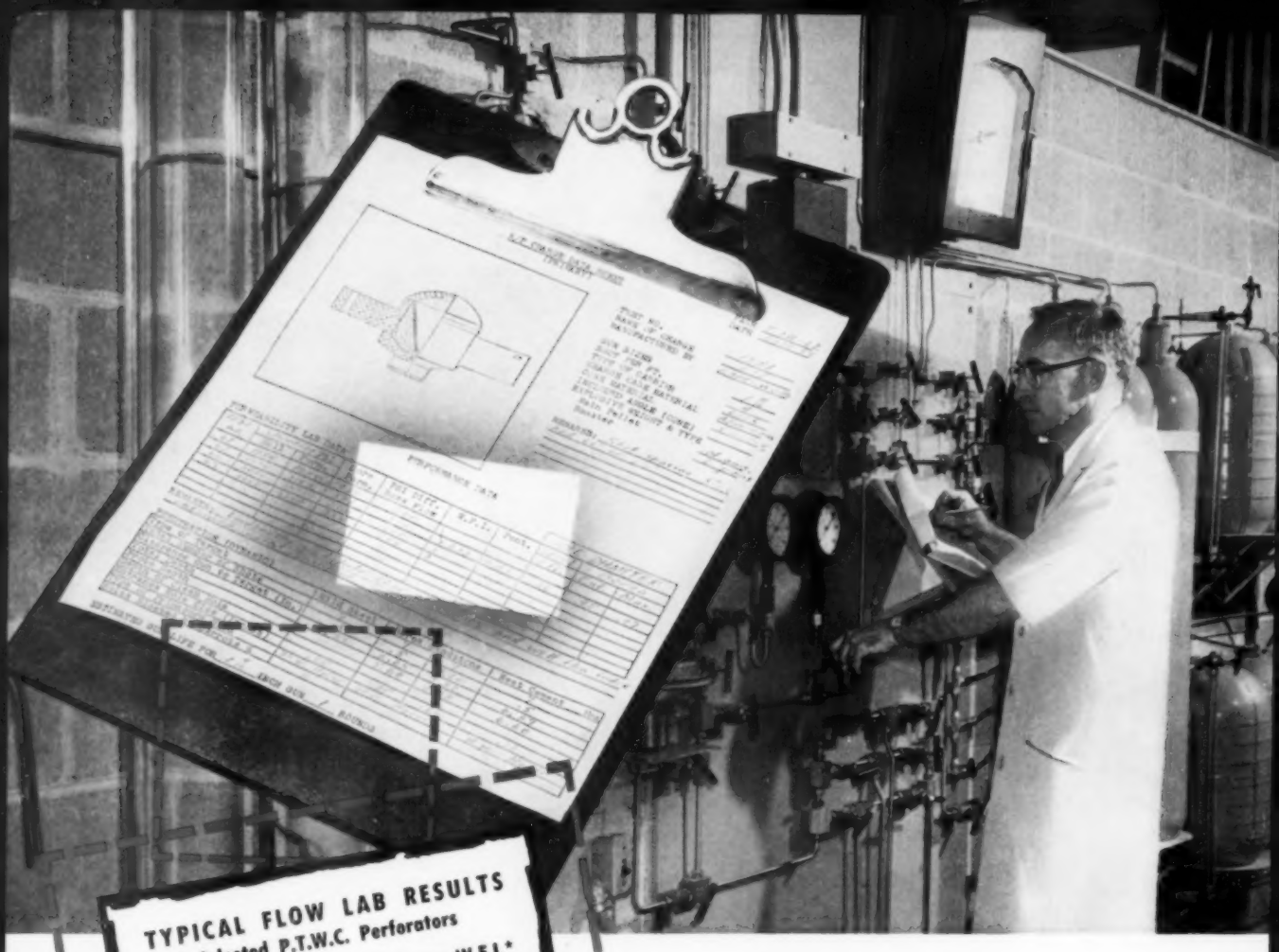
Air Pollution

p. 87

Open Letter to Congress on Harris Bill p.62

Imports Due Quick, Top-Level Review p. 64

Tough drilling, but
A Big Year for Offshore California p. 68



TYPICAL FLOW LAB RESULTS
Selected P.T.W.C. Perforators

Perforators	Average W.F.I.*
1 11/16 Bearcat	1.13
2 3/16 Bearcat	1.06
1 11/16 Swing Jet	.96
1 11/16 Competitor A	.92

*Well Flow Index is the ratio of the flow through the perforated core to the flow through the same core prior to perforating.

Documented
PERFORATING PERFORMANCE

FROM THE LABORATORIES OF LANE-WELLS COMES A NEW MEASURE OF PERFORATING EFFECTIVENESS

For more than a year Lane-Wells Flow Laboratory engineers have been testing perforators under pressure and temperature conditions duplicating those found underground . . . accumulating data to help you evaluate perforating. Perforations made under various formation-to-hole pressure differentials in formation samples and the subsequent flow rates provide an index of perforating effectiveness. This WFI (well flow index), together with other accepted perforating performance values, gives you more information than has ever been available before. Ask your Lane-Wells man about this newest Lane-Wells research contribution in the interest of improved petroleum production.

LANE-WELLS COMPANY

P. O. BOX 1664, HOUSTON 1, TEXAS

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Feb. 17, 1958

The oil industry is snake-bitten on the gas bill:

Tendency is to write off the Harris bill as dead after disclosure of Porter letter inviting oil men to the $100-a-plate appreciation dinner for Rep. Joseph Martin (p. 66).

But this is being changed by new strategy.

Plan now is to delay action on the bill, regroup oil's shattered forces in Washington, and work harder.

There's no doubt chances of the bill have been hurt.

But still the cause may not be lost.

Price softening has spread to Venezuela.

Shell last week cut its postings by 5 to 15 cents a barrel on 11°-23° gravity crude in the Maracaibo area. The cuts likely reflect recent 20-cent reduction in eastern U. S. fuel oil prices.

Several localized price cuts, meanwhile, occurred in Oklahoma, Ohio, and the Tri-State area. But the main price structure is holding firm.

Oil-company personnel chiefs will want to keep in touch with curriculum changes now taking place in the nation's top engineering schools.

What's happening? The educators are beginning to design engineering courses to give students more math, physics, and general scientific training at the expense of the more technical training.

Theory is that the students will have better fundamental backgrounds and will be able to undertake a greater variety of industrial tasks.

What it means to industry, however, is this: Much of the technical training will be left to employers. It should greatly expand on-the-job training programs.

Industry plans to celebrate 100 years of oil in 1959 are still very much confused.

The API's original plan to lay out about $5 million for a series of eight hour-long television shows has fallen flat. Companies asked to foot the bills balked.

Result at the moment is that nothing definite is in the works to call the nation's attention to the anniversary.

Magnolia is doing the industry a favor by releasing cost figures on its record-breaking Oklahoma dry hole.

They show the public how costly a dry hole can be.

Magnolia says the 1 Sterba cost the company and its partners $1,054,500 or about $4.25 an inch (p. 74).

The breakdown: $84,000 for tangible items: $580,000 for drilling, location, and roads; $37,500 for coring, fuel, surveys, and testing; $245,000 for mud, chemicals, cement, and cement service; $7,000 for trucking, perforating, and acidizing; $31,000 for bits; $70,000 for equipment rental and miscellaneous.

A casing patch for repairing holes in casing of oil and gas wells has been designed by Pan American Petroleum (p. 72).

The patch is like the well-known tire patch. It's easy to apply, economical, and withstands high pressure.

Applied inside the casing with an inexpensive inflatable mandrel, the plastic-impregnated fabric seals the hole, and glues itself to the casing.

Production men will be interested in the results of an unusual water-flood test in two Kansas fields.

The experiment showed that nonionic surfactants added to the water caused two beneficial results: Increased water-injection rates and higher rate of oil recovery.

The two floods were located in the Paola shoestring of Miami County, Kansas. Operator, by using the surfactant, displaced in 2 years about the same percentage of recoverable oil as obtained in 5 years in a similar field where it was not used (p. 105).

The Rocky Mountain region continues to grow in stature as an exploration province.

First month of year saw 27 oil and gas discoveries in Colorado, Western Nebraska, Utah, Wyoming, Western New Mexico, Montana, and North Dakota.

Most significant finds were in Williston, Green River, and Denver basins.

New oil-producing zones have been found by Aramco in tests of company's second offshore field in Persian Gulf.

Aramco says its Manifa 1 is testing zones that do not produce anywhere else in Saudi Arabia. Zones were not named but they lie between 7,600 and 8,300 ft., between the Lower Cretaceous Zubair sandstone and the Jurassic limestone Arab zone (p. 83).

The Yakutat wildcat in Alaska of Colorado Oil & Gas is now being reevaluated.

Operator is now below 11,400 ft. and probably will go below the 11,500 ft. projected depth.

No commercial shows have been encountered. But high-pressure gas zones encountered in drilling are keeping the company enthusiastic about productive possibilities.

Lake Maracaibo has yielded two new discoveries:

Phillips has a strike in Block 10. The wildcat flowed at rate of 4,080 bbl. daily through ¾-in. choke.

Signal has completed second flush wildcat in Block 4. It also flowed 4,000 bbl. daily.

Both blocks are owned by American syndicates.

Oil men who should know insist economics and not politics is back of the sales of Gulf and Texaco crude-gathering systems in Oklahoma to Kerr-McGee.

There has been talk that Oklahoma Corporation Commission policy forcing buyers to take full allowables prompted the pullout of Gulf and Texaco.

Pipeliners say, however, the fact is that Kerr-McGee with a refinery in Oklahoma and similar gathering lines is able to make the systems pay whereas they were a high-cost marginal operation for the two majors.

An intrastate gas pipeline from West Texas to Dallas is in the talking stage.

Reports indicate a large independent oil company is trying to sew up West Texas reserves for the project. It would give Dallas residents an alternate supply of gas and furnish large volumes of fuel for industrial expansion.

Air Force is considering expanding its product pipelines linking air bases to refineries.

Now 21 bases are connected to refineries. Nine more may be linked.

Air Force has found that personnel needed to handle products is cut 75 per cent, paper work reduced 90 per cent, and losses due to handling cut 75 per cent by using pipelines.

Study made at two air bases shows joint saving of half million dollars with installation of products lines.

A new labor accord is expected to benefit oil refineries, chemical plants, utilities, and steel mills.

Agreement reached at Miami between CIO-AFL building trades unions and National Constructors Association will encourage use of labor-saving machinery and erase wasteful featherbedding practices that have arisen since the war.

John F. O'Connell, a Bechtel vice president who signed the pact for the constructors, predicted construction will be stimulated by the new arrangement.

Don't say goodby to thermal cracking yet.

Despite decline in this type operation, some new vis-

breakers are still being built. And if cat gasoline continues to be crowded out of the premium-grade motor fuel, refiners may resort to less expensive thermal means of cracking.

The reason: Thermal end products can be hydrogen-treated and reformed, isomerized or alkylated as readily as the catalytic-cracked stocks.

Look for another application of radioactive tracers.

Very precise results in blending petroleum products can be attained by using low concentrations of these tracers.

Application lends itself completely to automatic control. The real hitch: Staying within regulations on radioactivity carried over into the blended product. But this probably can be licked before long.

Don't blame engine deposits solely on lube oils.

They're formed about equally from oil and fuel.

Sun Oil's Dr. James L. Lauer reports studies by his company showed the carbon deposit formed from lubricants contains more oxygen, is denser, and adheres more tightly to engine walls.

But gasoline contributes about as much to deposits as lubricants, he said.

First comprehensive report on what air-pollution control is costing refiners is now available.

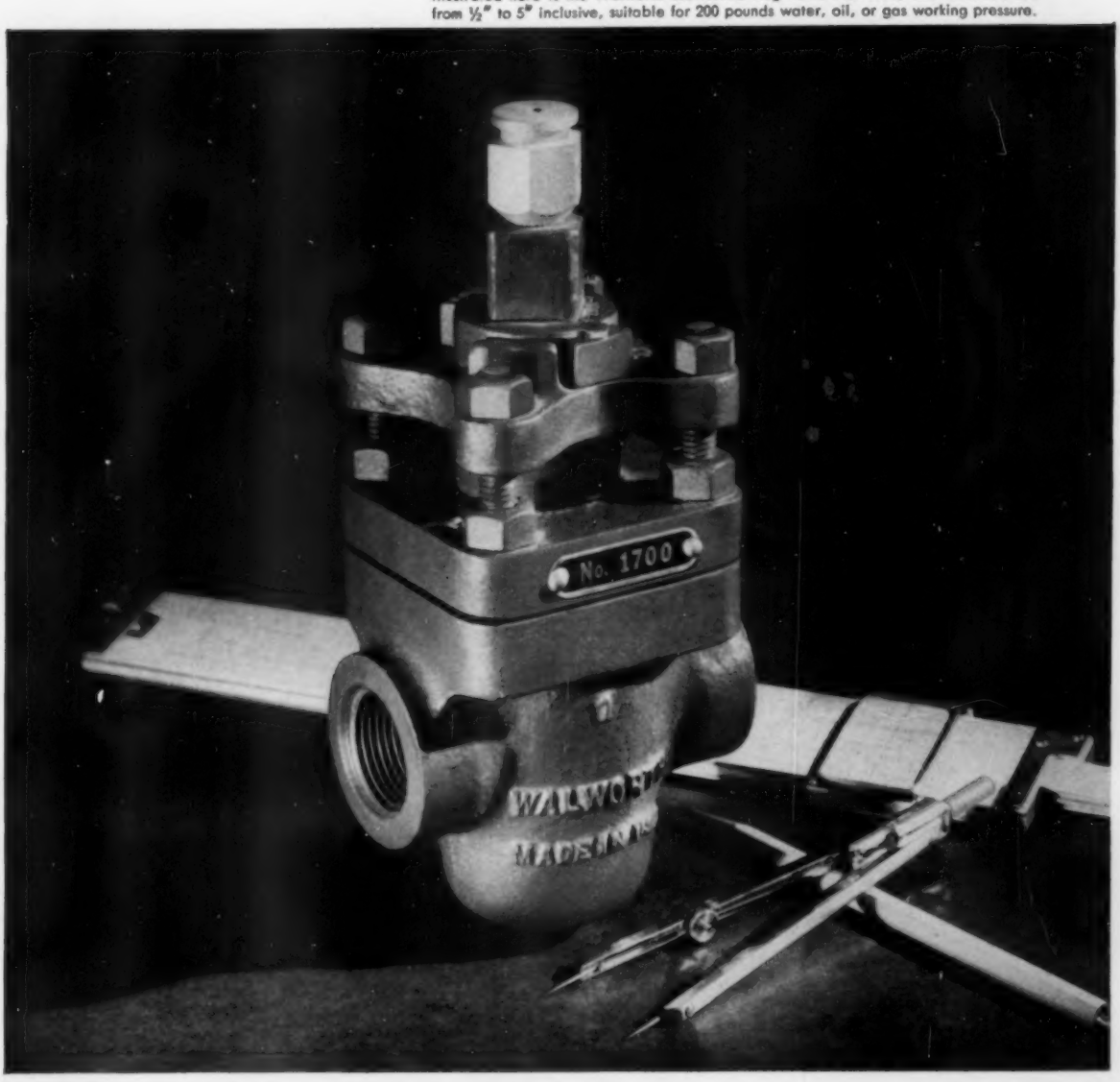
The cost: Outlay of $46 million in the last 2 years alone. Another $20.5 million this year. Plus about $1 million annually for research.

But cost is only part of the information revealed by a Journal nationwide survey. The study shows how management is organizing to control pollution, what's ahead in research, and how cities are attacking the problem (p. 87).

Petrochemical notes: Production of petroleum-derived aromatics continues on sharp upswing. But some petrochemical plants on Gulf Coast still bring in benzene from European coke-oven sources. In fact some shipments originate in iron curtain countries...Eastern States Petroleum & Chemical Corp. is still betting heavily on aromatics. It has third Udex unit in operation at its Houston refinery. Previously firm had pioneered in aromatics with Platformer and Udex units.

Passing parade: California governor will call special session of legislature to consider measures to halt costly subsidence at Wilmington field...Union Oil has cut cost of retorting oil shale to less than $1 bbl., is now shooting at 50 cents bbl....Amerada is planning a major secondary-recovery program in North Dakota's big Beaver Lodge and Tioga fields...Socony soon will start work on a 40,000-bbl. refinery at Caribbean terminal of its new Barinas-El Palito crude pipeline in Venezuela.

Illustrated here is the Walworth Lubricated Plug Valve No. 1700, available in sizes from ½" to 5" inclusive, suitable for 200 pounds water, oil, or gas working pressure.



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EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY—OPERATION

Refining-Processing

Special Report: Air-Pollution Control . . . 87-102

By D. H. Stormont

As the result of a 40-company survey, with replies covering 77 per cent of the nation's refining capacity, here is the first comprehensive report on how refiners are approaching the problem of controlling their wastes and what it is costing them.

The study breaks down into four parts: (1) Cost of pollution control, with expenditures broken out on area basis and based on class of pollutants; (2) Organization for control, pointing up the importance of positive action by management; (3) What researchers are doing with the $1,000,000 spent annually to learn about chemistry of the atmosphere; and (4) Trends in legislation regarding pollution.

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Surfactant Can Hike Water-Injection Rate . . . 105

By H. J. Schneider, H. L. Greenwald, D. L. Felley, and R. F. Lollar

Nonionic surfactants, added at 20 p.p.m. from the start of the flood, enabled the operator to displace in 2 years about the same percentage of recoverable oil as obtained in 5 years in a control flood where surfactant was not used.

Elements of Field Processing—48 . . . 111

By Dr. John M. Campbell

Part 2 in the current series on calculation of enthalpy—an examination of fundamental equations.

Drilling for Gas Is Stepped Up in North Arkansas . . . 112

By Norman S. Morrisey

Currently some 20 rigs are active in northwestern Arkansas. Air and gas drilling is being used predominantly. With the continuous drillstem test, few shows of gas are overlooked during operations.

First LACT Unit Is Star Performer . . . 114

Drilling Clinic Solves Problems . . . 115

By Norman S. Morrisey

Quarterly conferences between management, tool pushers, and drillers to upgrade personnel and build more efficient crews, work for Carpenter-Trant Drilling Co.

Water Flooding Is Successful in Europe's Biggest Field . . . 116

By Joseph A. Kornfeld

Pressure decline has been halted and the Parentis field in southern France is now producing 26,834 bbl. daily.

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By Dewey Follett

Slim-hole and dual completions are proving almost universally successful on small producing leases. Here is a roundup on the current status of these techniques.

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By A. L. Berry and B. L. Moreau

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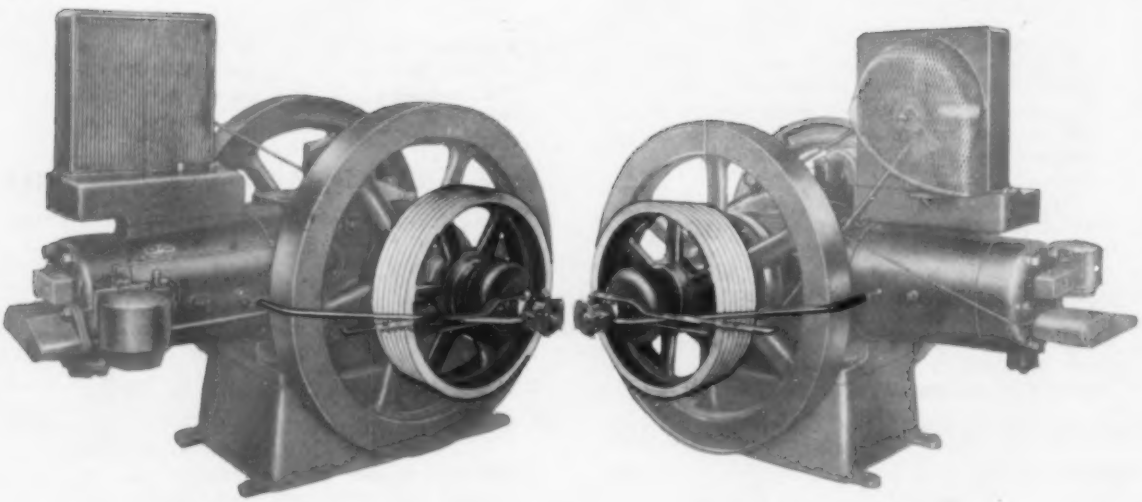
Here...or here...



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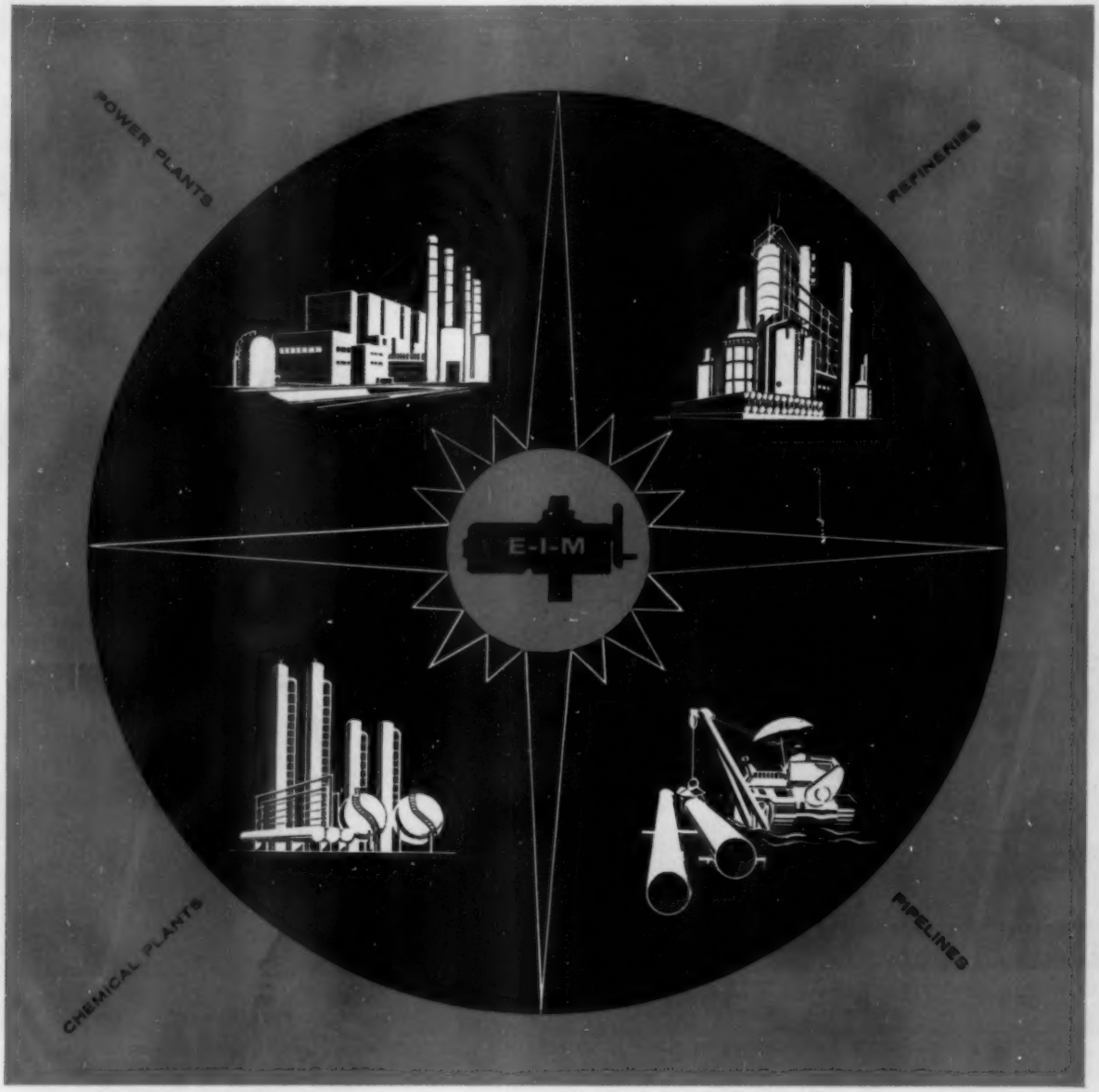

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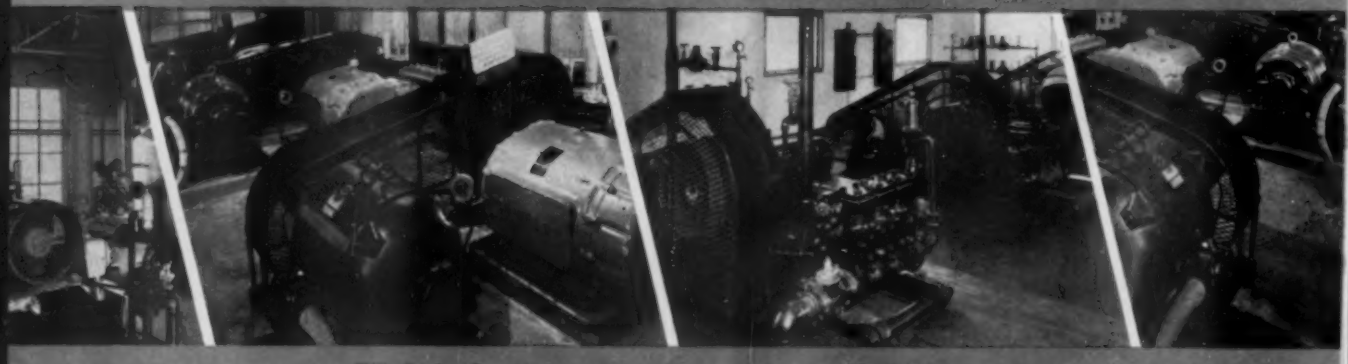

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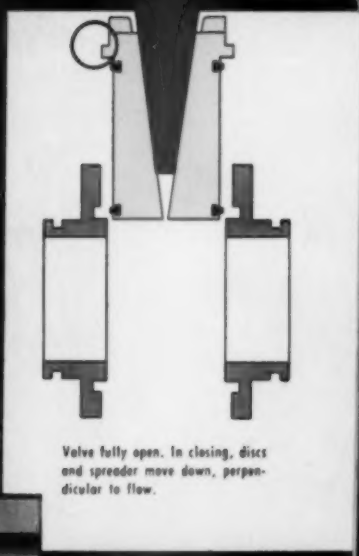
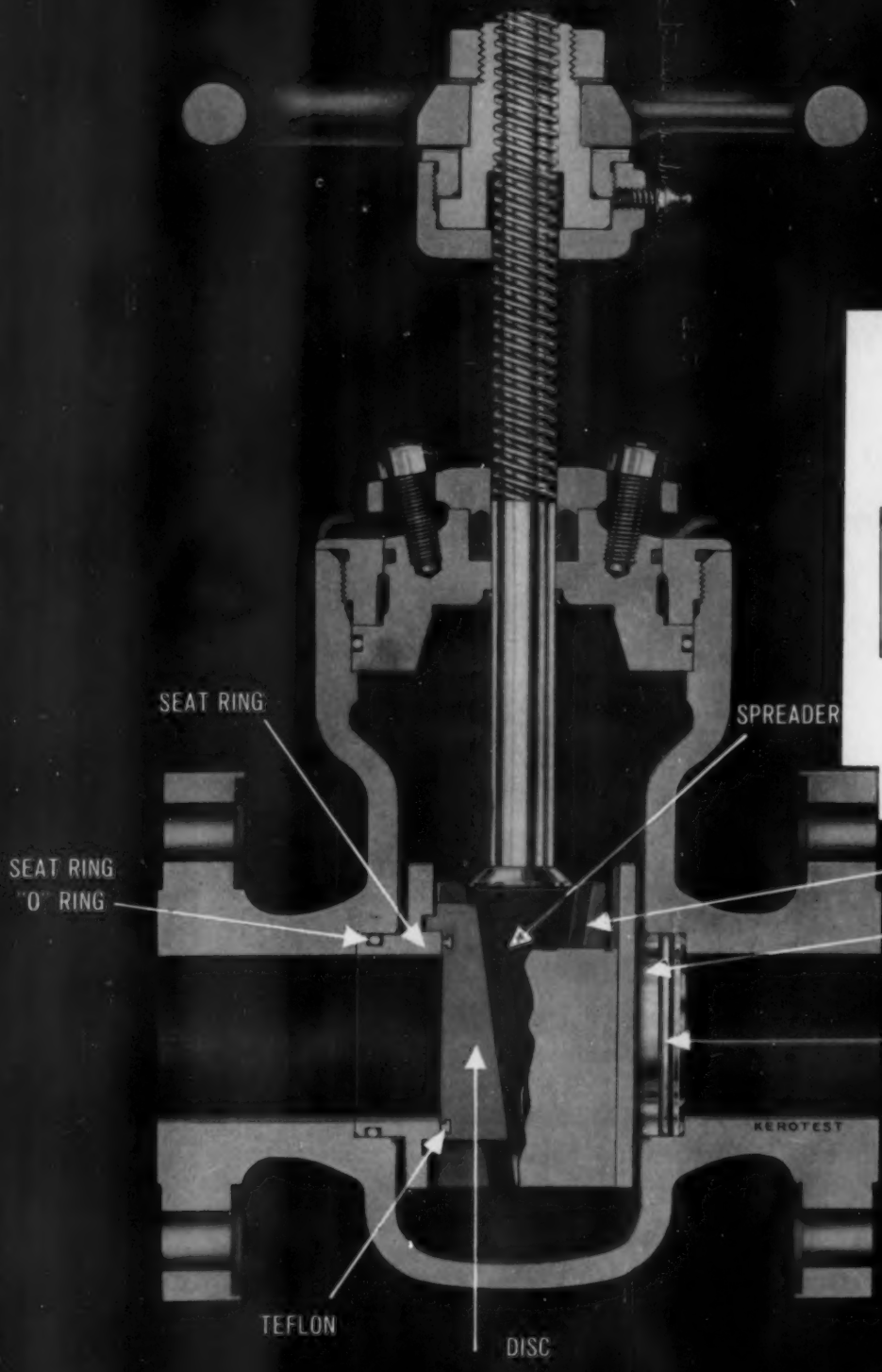


Valve fully open. In closing, discs and spreader move down, perpendicular to flow.



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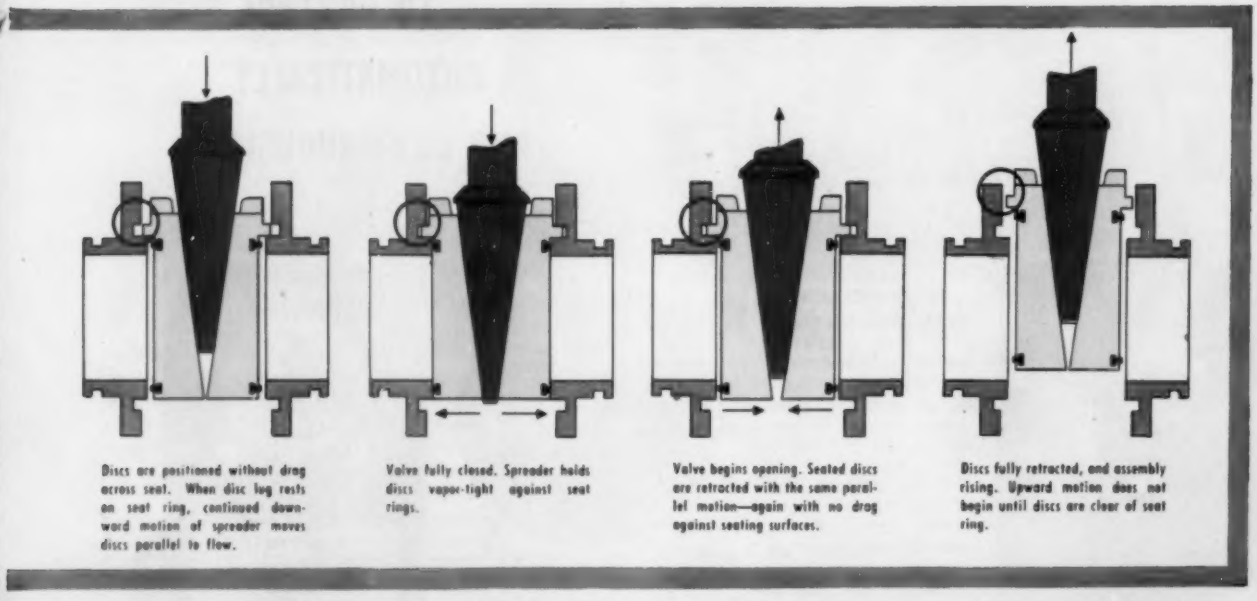

Discs are positioned without drag across seat. When disc lug rests on seat ring, continued downward motion of spreader moves discs parallel to flow.

Valve fully closed. Spreader holds discs vapor-tight against seat rings.

Valve begins opening. Seated discs are retracted with the same parallel motion—again with no drag against seating surfaces.

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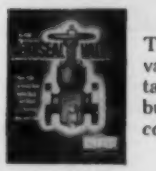
In opening, the first movement of the stem retracts the discs so that they clear the seat rings, and further movement raises the discs until they reach the fully open position.



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★ Specific Gravity

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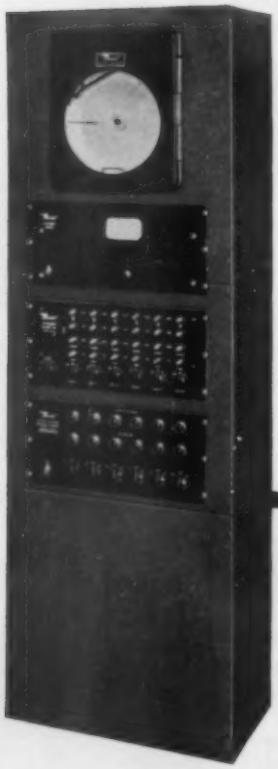
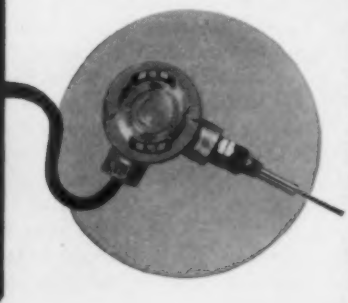
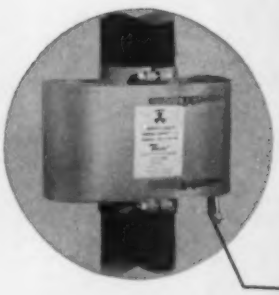


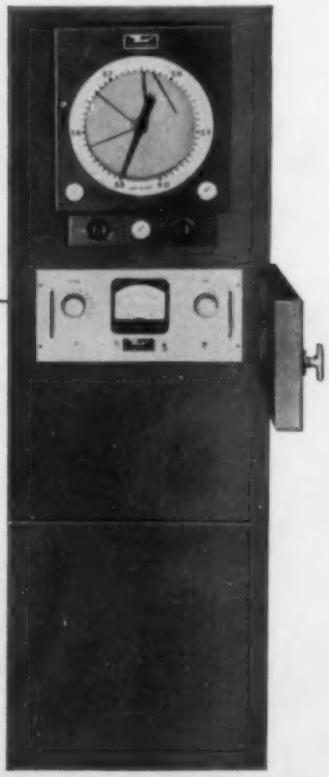
BENDIX ULTRA-VISCOSON*

Provides continuous and automatic viscosity control of from one to six individual stations in a single system. Ranges: 0-50,000 centipoises X grams /cc. Proven uses in liquid blending, fuel atomization or refinery applications in the petroleum, chemical, steel, gravure and flexographic printing, resin, adhesives, paint finishing and various other fields. Ultra-Viscoson systems are available to fill most industrial and research requirements.

*REG. U. S. PAT. OFF.







BENDIX NUCLEAR DENSITY GAGE

Provides continuous and automatic control of fluid density in process pipelines. Range: 0.5 Sp. Gr. and up, with adjustable spans. Ideal for use with abrasive, corrosive, viscous and high-pressure processes; sensing element does not contact process material. Applications: Density, specific gravity, liquid concentration, vapor/liquid ratio, liquid level, slurry control and interface detection. Range, span and time constant adjustments from front panel.

For complete information write
Cincinnati Division, Dept. 330, 3130 Wasson Road, Cincinnati 8, Ohio.

Cincinnati Division

Export Sales: Bendix International Div., 205 E. 42nd St., New York 17, N. Y. Canada: Computing Devices of Canada, Ltd., Box 508, Ottawa 4, Ontario

Bendix
AVIATION CORPORATION

DOW CORNING CORPORATION

Silicone News

FOR PETROLEUM MEN — No. 3

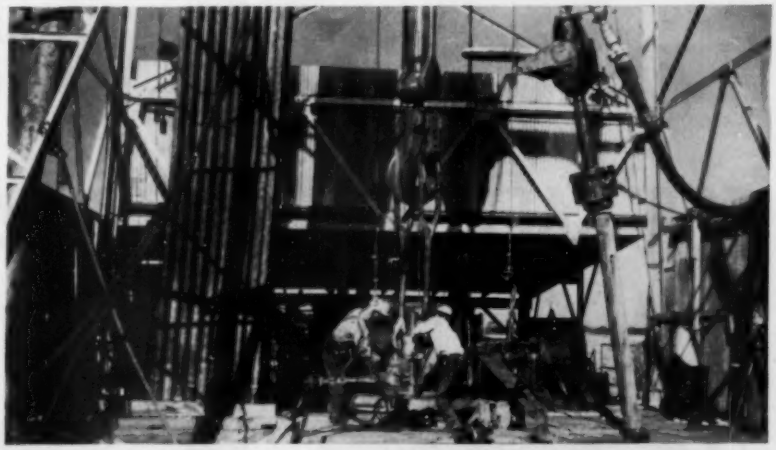
How to End Wire Burn-outs

Do you have electric wire or cable that's exposed to high ambient temperatures? If so, here's a way to avoid burn-outs and save real maintenance money.

A Gulf coast refinery was plagued with frequent failures of wiring on a hydroformer. Temperatures ranging up to 250 F caused conventional wire insulation to

burn out in as little as three months. Refinery engineers then replaced some five miles of the old wire with silicone rubber covered wire. Result: excellent service. Wire covered with Silastic*, the Dow Corning silicone rubber, has eliminated so much downtime and saved so many man-hours in this refinery that it is now specified for all new and replacement wiring in areas where it will be subjected to over 140 F. Ask your own supplier about heat and moisture resistant wire and cable insulated with Silastic. *No. 9*

*T. M. REG. U. S. PAT. OFF.



SAVE WITH SILICONE INSULATION

Silicone insulation improves operation of drilling rig brakes and couplings — minimizes failures.

The Baylor Company of Houston, manufacturer of drilling auxiliaries, has now switched to silicone insulation on all its Elmagco magnetic brakes and couplings. Savings are reported to be substantial.

Elmagco brakes are designed to dissipate energy at rates up to 5000 hp in lowering drill strings. In operation, however, unforeseen circumstances can cause higher demands. For example, in one case the supply of cooling water failed while a 12,600 foot string was being lowered. Total energy developed while lowering the string the rest of the way to the bottom was estimated at a billion and a half foot-pounds. The brake got so hot it glowed. The motor rotor warped and was ruined. Yet afterward, the silicone insulated coils in the stator tested out as good as new!

Baylor guarantees its brakes and couplings for one year — has been able to provide a more dependable unit and yet hold the price line through savings such as cutting first-year replacements of coils from 30 percent of total production down to 0.55 percent.

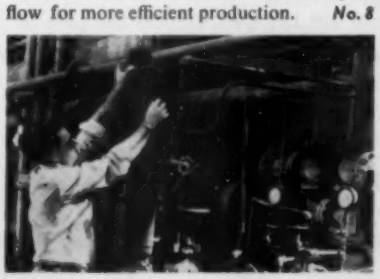
In pump motors, transformers and other electrical equipment, the story is the same: heat resistant silicone insulation gives more muscles for the money. *No. 7*

Silicone Defoamer Steps Up Refinery Production

Wherever smooth, efficient production is hampered by a foaming problem, one of Dow Corning's versatile silicone defoamers will usually provide an effective and economical solution.

A Texas refinery is successfully using Dow Corning Antifoam A to curb foaming in a 15% solution of diethanolamine (DEA). The DEA removes hydrogen sulfide and carbon dioxide gases from a propane-propylene gas stream. Formerly, it foamed severely.

The DEA solution is introduced into the gas stream where it absorbs the acid gases; the acid is then driven off with heat and the DEA is used over again. Antifoam A is added to the lean DEA solution whenever foaming develops. Approximately 1 quart of Antifoam A injected every 3 weeks into 200 barrels of the circulating DEA solution assures an uninterrupted flow for more efficient production. *No. 8*



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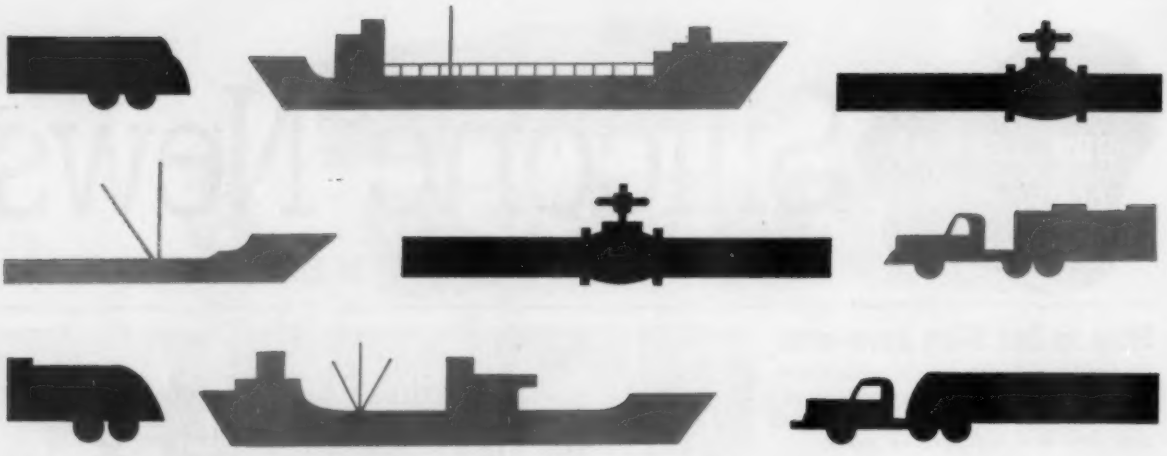
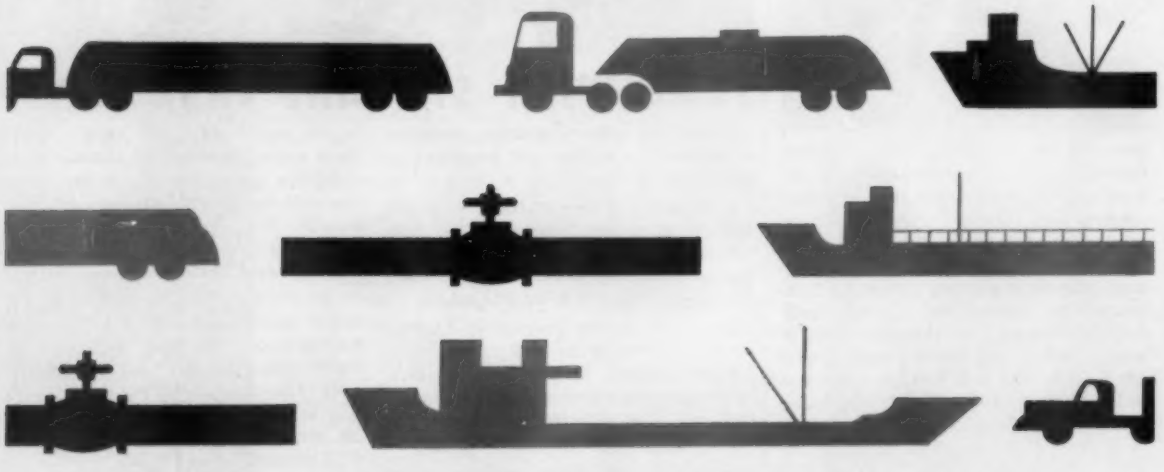
Canada: Dow Corning Silicones Ltd., Toronto; **Great Britain:** Midland Silicones, Ltd., London; **France:** St. Gobain, Paris



FOR SAFE TRANSPORT-LAND AND SEA
SHAND AND JURS TANK FITTINGS



For over 35 years, Shand and Jurs has pioneered in the design and manufacture of mechanical tank fittings for truck tanks, marine tankers and pipeline installations. S&J offers petroleum transporters the world's most complete line of valves, gages, fittings and controls for maximum safety and economy in the movement of petroleum products. Convenient Shand and Jurs branch offices and sales representatives are ready now to help you with your tank fitting problems. Call them today.

SHAND AND JURS

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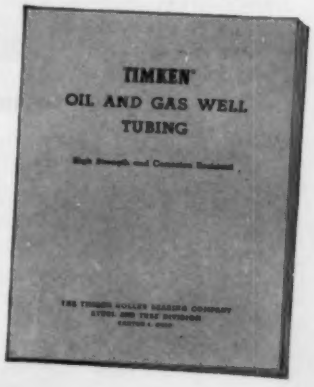
And Timken seamless steel tubing goes beyond the stiffest specifications of the American Petroleum Institute. The highest API specification—5A—calls for a yield strength of 105,000 psi. We offer you up to 125,000 psi yield strength, with maximum uniformity of properties and quality.

Timken seamless steel tubing is available in a variety of sizes and analyses. Some are specially selected for corrosion resistance. All provide high ductility.

Into every foot of Timken seamless steel tubing goes 24 years of experience in pioneering high pressure seamless steel tubing applications for the petroleum and other industries. Several extremely deep oil and gas wells are now using Timken seamless tubing with very satisfactory results.

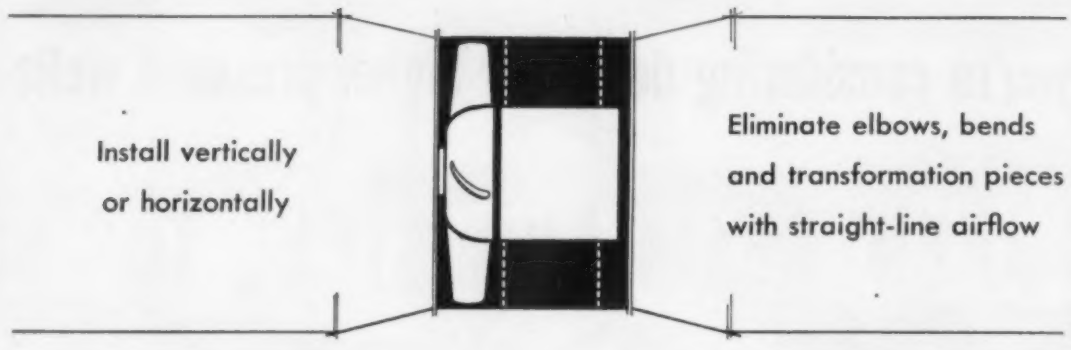
FREE ENGINEERING STUDY
A recent study by Timken Company metallurgists reviews the properties of various alloys and their application to oil field operation. Get your free copy today of "Timken Oil and Gas Well Tubing". Write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".



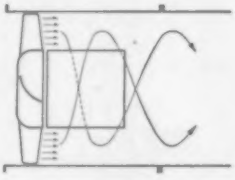
TIMKEN Fine Alloy STEEL

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

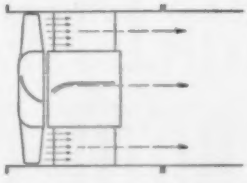


Large-diameter hub and die-formed blades insure uniform air velocity from hub to tip.



TUBEAXIAL

Air discharge follows a spiral path, then straightens out a short distance from fan at moderate pressures.



VANEAXIAL

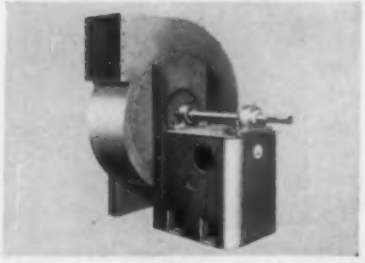
Air discharge is transformed into useful energy by directional guide vanes, increasing efficiency, pressure.

American Blower axial fans deliver the volume you need; fit the space you have!

Whatever your air-moving problem – ventilating, heating, drying or processing – you'll find an economical solution in the complete line of precision-built American Blower fans. *Plus-value:* Rugged construction of every American Blower fan gives you extra years of low-cost service with minimum maintenance.

Seventy-three American Blower branch offices from coast to coast – are staffed by skilled sales engineers. Ask them to help you select the right equipment for *your* job. Call today! American-Standard, American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

It pays to standardize on American Blower fans for every duty!



Industrial Fans—three wheel-options

HS Fans – nonoverloading, minimum power

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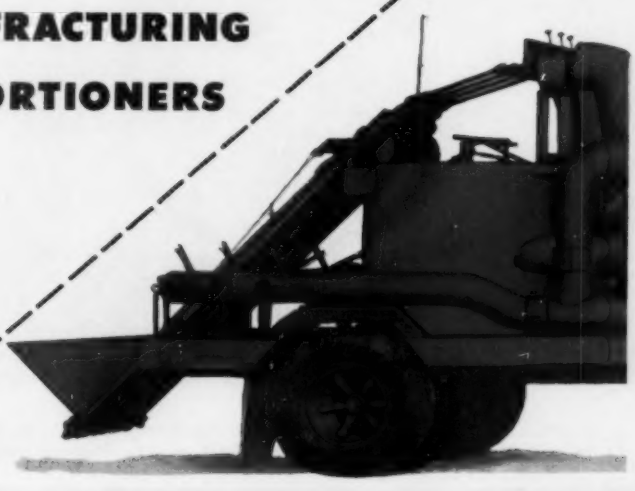
Get your free copy of the new "Elements of Hydraulic Fracturing". Call your Halliburton representative.

Constant Control of Sand-fluid Ratios

WITH

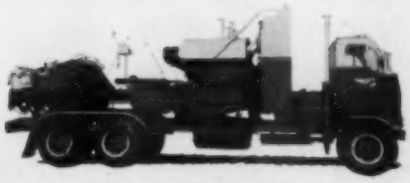
HALLIBURTON FRACTURING PROPORTIONERS



You get all the advantages of accurate variable proportioning equipment for continuous regulation of sand-fluid ratios when you call on Halliburton for hydraulic fracturing. These versatile proportioners provide for immediate change of ratios at any time and maintain desired ratios over a wide range of injection rates.

Halliburton fracturing personnel are specially trained in the operation of these proportioners, experienced in the application of the sand-fluid ratios best suited for your wells. This combination of men and machines results in better formation fracturing.

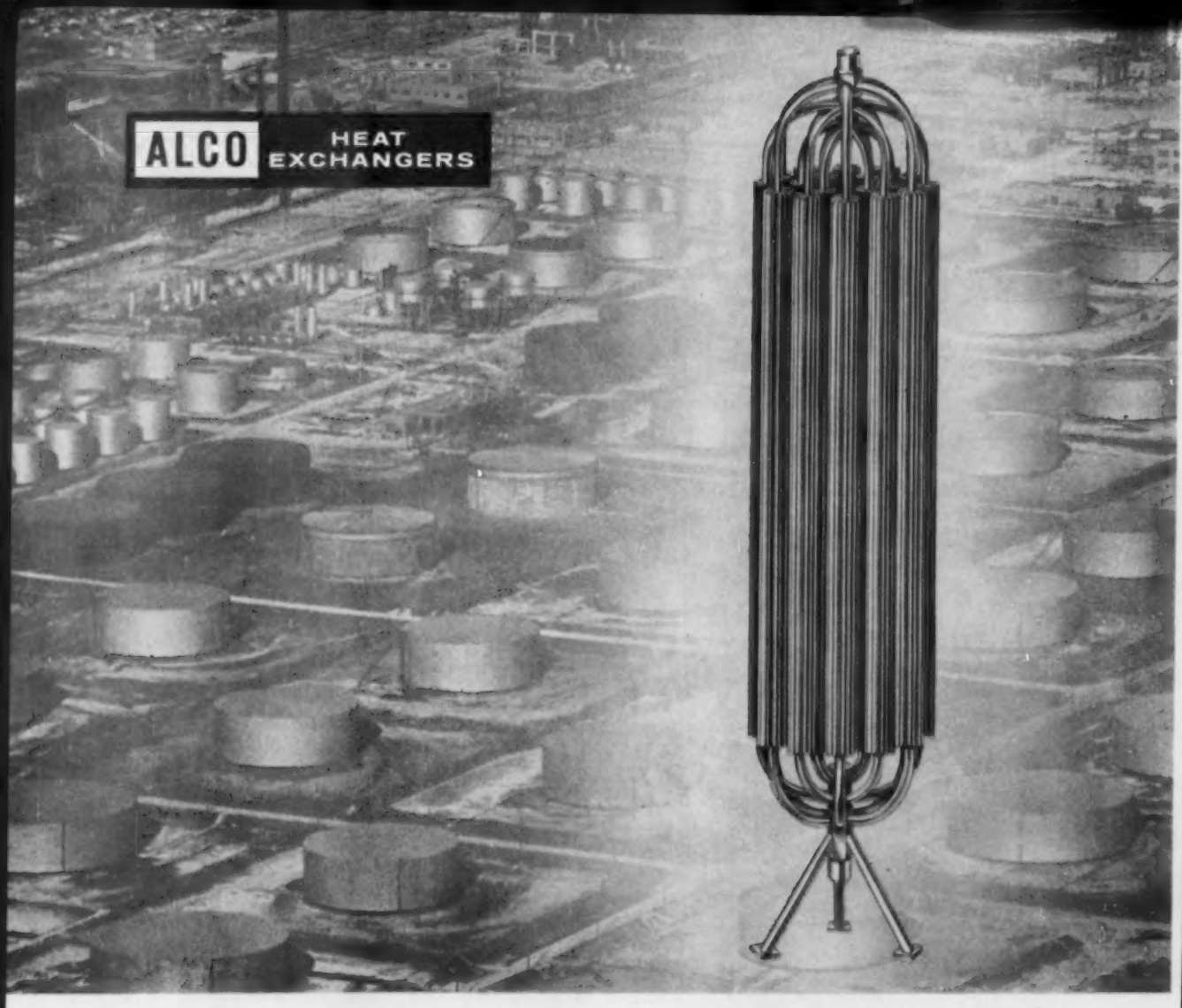
Get constant controlled sand-fluid ratios in your next fracturing job. Specify Halliburton... foremost in formation fracturing.



HALLIBURTON FRACTURING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

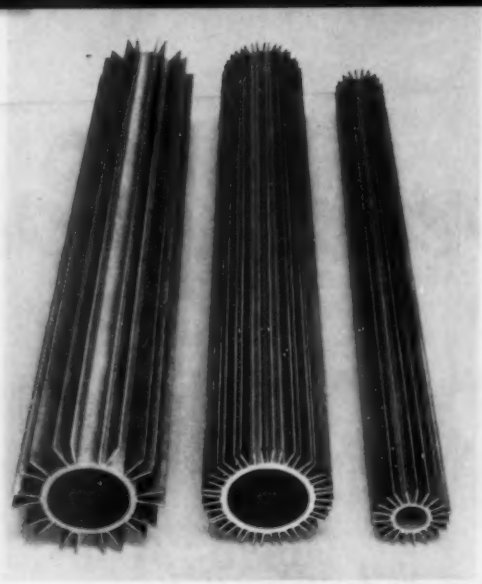
THE PIONEER IN FRACTURING SERVICES



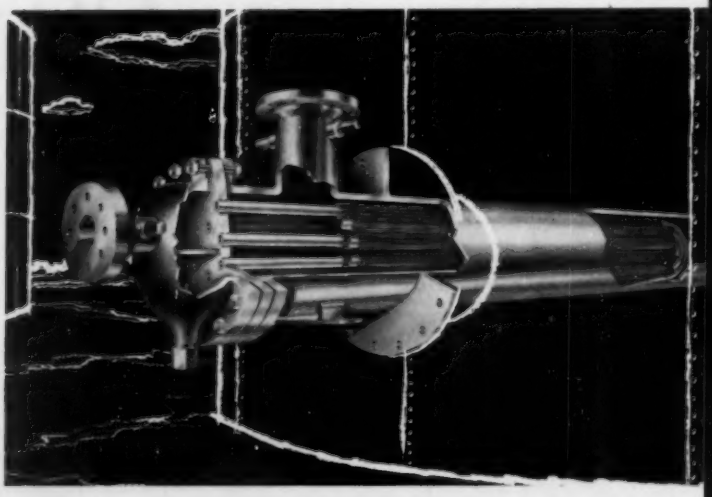
ALCOHEATER'S *fin tubes provide high rate of heating for easier transport of viscous fluids. Design promotes thermal circulation. Unit can be passed through standard manhole for easy installation.*

THERE'S NEW HEAT-TRANSFER PERFORMANCE IN ALCO FIN TUBES

Crown and travelling blocks • Oil-field valves • Wellhead equipment • Kinney plug injectors • Finned tube products



ALCO's *new welding process allows wide range of fin and tube metallurgy. Recent installation combined copper fins with Admiralty tubes.*



Tank suction heater by ALCO *uses fin tubes for straight-line heating with minimum pressure drop. Cool fin surfaces resist coking or fouling.*

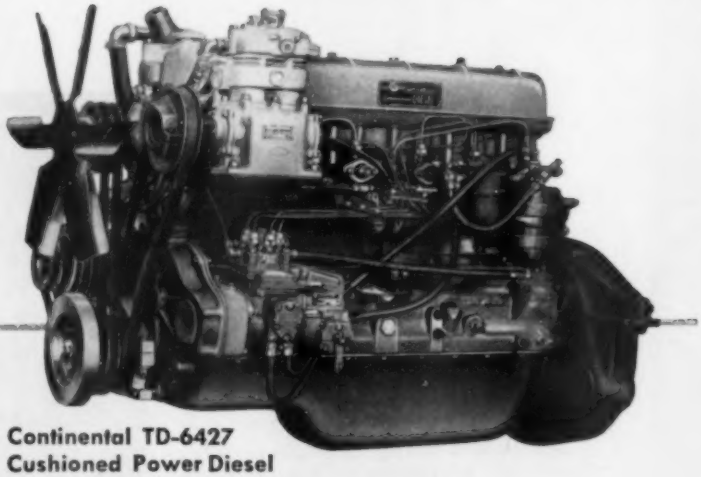
Using a new welding method, ALCO is producing integral fin tubes that have a higher heat-transfer efficiency. Longitudinal fins are welded to the tubes with a positive metal-to-metal union throughout their entire length. There are no spaces between fin and tube to lower heat transfer, and complete contact is assured throughout thousands of heating and cooling cycles.

ALCO is now using these improved fin tubes in exchangers like the ALCOTWIN®, ALCOHEATER and tank suction heater. The high heat-transfer rate, greater surface area, and resistance to coking or fouling combine to make these units highly efficient, flexible and easy to maintain.

The new integral fin tube is manufactured in a wide range of metallurgies for your process requirements. Complete information is available from any ALCO sales office, or write Petroleum Industry Equipment Division, Dept. 182, Bank of the Southwest Building, Houston, Tex.

ALCO **ALCO PRODUCTS, INC.**
Petroleum Industry Equipment Division
HOUSTON

Cushioned® Power IS THRIFTY POWER



Continental TD-6427
Cushioned Power Diesel

TRANSPORTATION DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
TD6427	6	4 5/16	4 1/2	427	116.0 @ 2400 RPM
RD6572	6	4 1/4	5 1/2	572	172.0 @ 2400 RPM
VD8603	8	4 1/4	4 1/4	603	182.0 @ 2800 RPM
SD6802	6	5 9/16	5 1/2	802	225.0 @ 2200 RPM

TRANSPORTATION GASOLINE ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N4062	4	2 1/8	3 1/2	62	26.3 @ 3500 RPM
Y4069	4	2 1/2	3 1/2	69	28.0 @ 3500 RPM
Y4091	4	2 1/8	3 1/2	91	36.0 @ 3400 RPM
F4124	4	3	4 1/2	124	47.0 @ 3200 RPM
F4140	4	3 1/16	4 1/2	140	52.0 @ 3200 RPM
F4162	4	3 1/16	4 1/2	162	58.0 @ 3200 RPM
F6186	6	3	4 1/2	186	77.0 @ 3500 RPM
F6209	6	3 1/16	4 1/2	209	90.0 @ 3500 RPM
F6226	6	3 1/16	4 1/2	226	98.8 @ 3500 RPM
F6244	6	3 1/16	4 1/2	244	105.0 @ 3750 RPM
M6271	6	3 1/2	4 1/2	271	96.5 @ 3000 RPM
M6290	6	3 1/4	4 1/2	290	108.0 @ 3000 RPM
M6330	6	4	4 1/2	330	125.0 @ 3000 RPM
M6363	6	4	4 11/16	363	146.0 @ 3000 RPM
B6371	6	4 1/2	4 1/2	371	123.5 @ 3000 RPM
B6427	6	4 5/16	4 1/2	427	142.0 @ 3000 RPM
K6271	6	3 1/2	4 1/2	271	114.5 @ 3200 RPM
K6290	6	3 1/4	4 1/2	290	123.0 @ 3200 RPM
K6330	6	4	4 1/2	330	147.0 @ 3200 RPM
K6363	6	4	4 11/16	363	162.0 @ 3200 RPM
T6371	6	4 1/2	4 1/2	371	143.8 @ 3000 RPM
T6427	6	4 5/16	4 1/2	427	170.0 @ 3000 RPM
U6501	6	4 1/2	5 1/4	501	178.0 @ 2600 RPM
R6513	6	4 1/2	5 1/2	513	192.2 @ 2800 RPM
R6572	6	4 1/4	5 1/2	572	220.0 @ 2800 RPM
R6602	6	4 1/2	5 1/2	602	232.0 @ 2800 RPM
S6749	6	5 1/2	5 1/2	749	250.0 @ 2800 RPM
S6820	6	5 1/2	5 1/2	820	275.0 @ 2800 RPM
V8603	8	4 1/4	4 1/4	603	240.0 @ 3200 RPM

A tip from fleet operators who have switched to Continental Diesel: When you're ready to "go Diesel," it pays, in more ways than just initial cost, to go the whole distance and get exclusive Red Seal Cushioned Power. In that way, you obtain fullest measure of ALL the advantages identified with engines of Diesel type. You use less fuel than with conventional Diesels. You have more cargo capacity because you're lugging less engine weight. And the wide interchangeability of parts between Cushioned Power Diesels and companion models in the Red Seal gasoline engine line expedites maintenance and sharply reduces parts cost.

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AUTHORIZED SERVICE
and genuine Red Seal parts available from coast to coast.

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Continental Motors Corporation
MUSKEGON, MICHIGAN

WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES. CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE, MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

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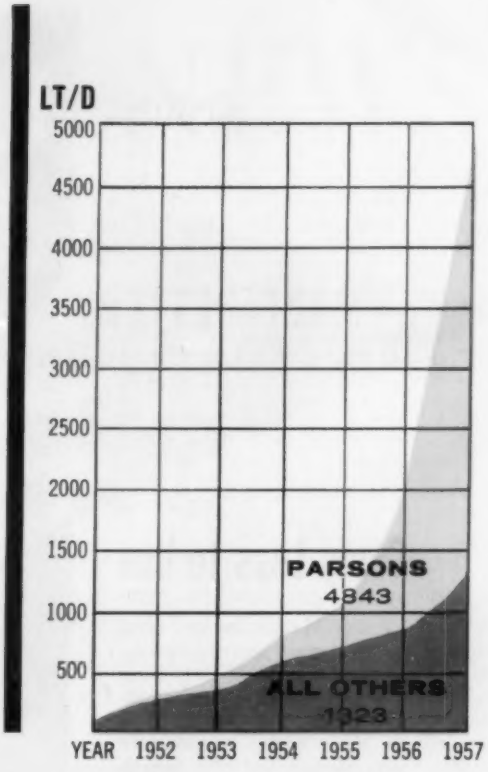
80%

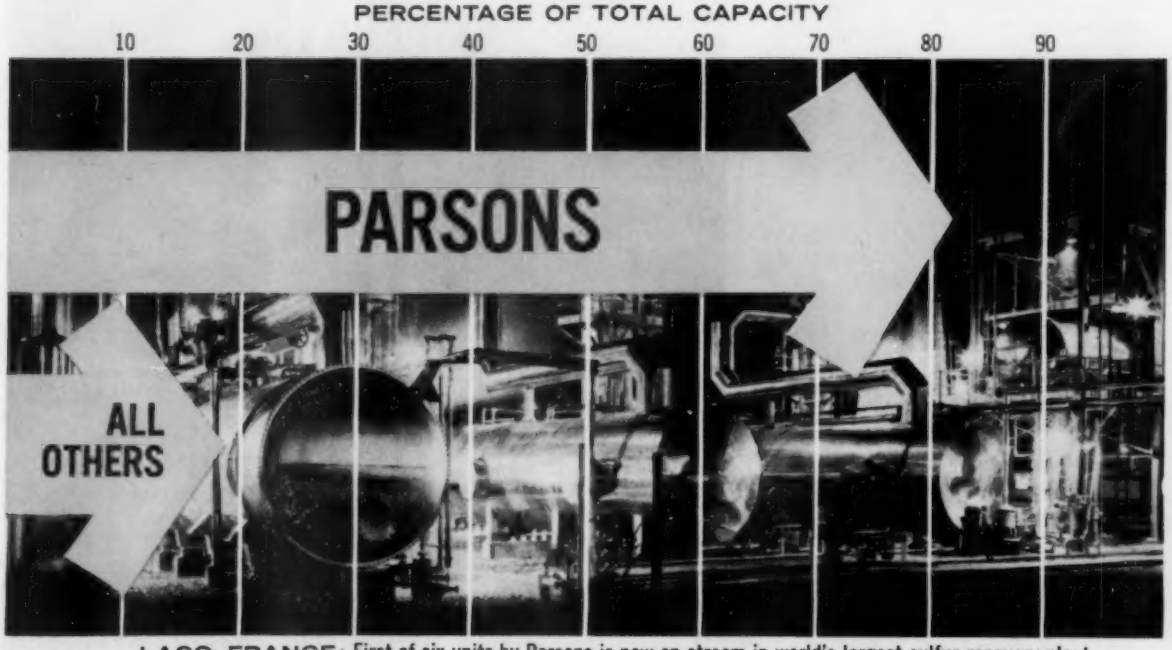
of the world's capacity for sulfur recovery

from H_2S gas is by

PARSONS

Proof Positive of Parsons' Performance!





LACQ, FRANCE: First of six units by Parsons is now on stream in world's largest sulfur recovery plant.

PARSONS means leadership

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JENKINS

O.S.&Y. U-BOLT GATE

MADE BETTER THAN NEED BE . . .

Costs Less to Use

YOU PAY NO MORE for the extra quality you see in every part of a Jenkins Outside Screw & Yoke U-Bolt Gate valve. Yet longer life and reduced maintenance is bound to result from the extra ruggedness, the precision manufacture and unique design features which Jenkins puts into these popular, general utility valves.

Choose the Outside Screw & Yoke pattern for services where spindle threads must be kept out of the destructive effects of fluids in the line; where spindle threads must be cleaned and lubricated regularly or where a rising spindle is needed to indicate wedge position.

Choose JENKINS, whether O.S. & Y. or Inside Screw pattern, for valves built to save maintenance dollars.

WIDE RANGE OF JENKINS U-BOLT GATES

GET FOLDER NO. 207 which describes Inside Screw and O.S. & Y. patterns . . . Iron Body with Bronze or Stainless Steel Mounting . . . All-Iron and Ni-Resist with type 316 Stainless Steel trim. Ask your local Jenkins Distributor or write Jenkins Bros., 100 Park Avenue, New York 17.

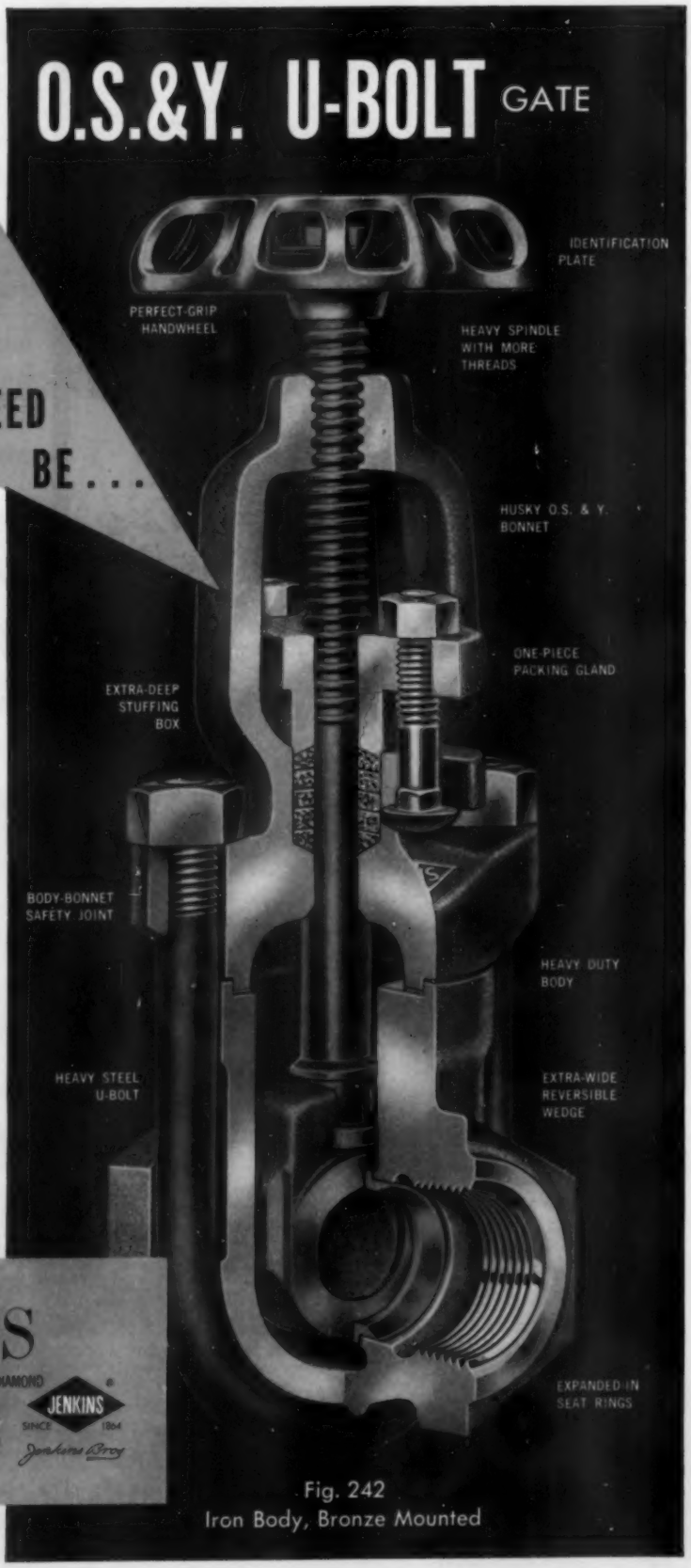


Fig. 242
Iron Body, Bronze Mounted

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864
Jenkins Bros.

Sold Through Leading Distributors Everywhere

DU PONT *Petroleum Chemicals* NEWS

Number 84 in a Series of Bulletins for the Petroleum Industry

FEBRUARY 1958

A STORY OF MEN AND EQUIPMENT

Turning DuPont's automotive research into service for refiners

by R. O. Bender

Adapting your fuels to satisfy the growing octane appetite of modern high compression ratio engines involves a rapidly changing technology. As a leading supplier of tetraethyl lead and other additives for petroleum products, the DuPont Petroleum Chemicals Division provides a wide range of services to help you keep pace with these constantly advancing fuel requirements.

PAUL RICHARD is a DuPont Petroleum Chemicals Division automotive liaison man in Detroit. He acts as a sort of "clearing house" for technical information of interest to both the petroleum and automotive industries.

Behind these services are the research experience and know-how of scores of DuPont chemists and engineers; the extensive facilities of the DuPont Petroleum Laboratories; and our continuing liaison work with the automotive industry. All these combined help us produce technical information that helps to bridge the gap between the automotive and refining industries.

Although most of our combustion chamber and other automotive research

COLOR...
boon to petroleum merchandising

DuPont, a leader in the research and manufacture of dyes since 1916, has developed brilliant, appealing colors for petroleum products.

Since the 1920's dyes have been used in gasoline to indicate TEL content. In later years refiners have become increasingly color conscious. Today, dyes are used in all types of petroleum products – kerosine, home-heating oils, tractor and diesel fuels, and lubricating oils and greases.

Merchandising value

The trend toward increased use of colors in petroleum products has been due largely to industry appreciation of its merchandising value.

In products other than gasoline, brand identification through the use of color can provide an important competitive selling advantage. This has been ably demonstrated by a number of motor oil and grease marketers.

Now, heating oil and diesel fuel suppliers are becoming increasingly interested in the merchandising value of petroleum dyes. The current interest in "premium" heating and diesel fuels seems to be apparently increasing the demand for merchandisable color.

A secondary but extremely practical reason to use petroleum dyes is leak detection. Color quickly points out wherever a leak occurs, making quick repair possible. Hence color in this use can greatly reduce loss of product and, at the same time, promote safety, protecting personnel against fumes, and property against the hazards of fire.

Let us help you

In addition to oil-soluble dyes for petroleum products, DuPont's over-all experience in the world of color covers a uniquely broad range of product categories – textiles, paints, colored plastics, photographic film, and basic pigments manufacture, to mention a few. And we are prepared to offer you the most comprehensive color assistance available in the additives field.

To take advantage of this assistance, you are invited to discuss your color selection and technical dyeing problems with one of our Petroleum Chemicals Division representatives.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

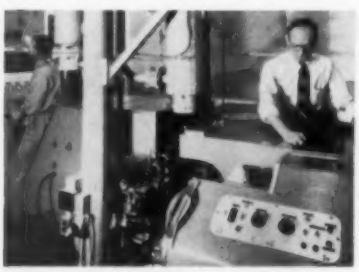
DU PONT *Petroleum Chemicals* NEWS

CONTINUED *Research Services*

activity centers around the Du Pont Petroleum Laboratory in Deepwater, N. J., an important part of our investigations has its roots in the automotive plants in Detroit. Paul Richard and Donald Diggs keep in close touch with new automotive engine developments. They study compression ratio trends as well as other design factors which may affect the quality of fuel the new engines will need. Their information is used at the Petroleum Laboratory to build or modify the future type engines in which fuel performance is studied. Between this close automotive industry liaison and the Laboratory's own investigations, our Petroleum Chemicals Division is able to offer the refining industry research information of timely interest and value.

Unique equipment used

To develop and tailor this information to your needs, the Petroleum Laboratory maintains a fleet of specially equipped and instrumented road test cars. These include advanced design, as well as current model engines. The electronics section of the Laboratory has developed also many unique instruments to study the mechanisms of knock and other abnormal combustion phenomena.



THIS SPECTROMETER is one example of the unusual equipment being used at the Du Pont Petroleum Laboratory for studying the chemistry of knock and the fundamentals of combustion. A single-cylinder engine, which can be seen in the center of the picture, is used in conjunction with the spectrometer.

Varied specialties

The staff at the Du Pont Petroleum Laboratory is unusually complete. It includes chemists, mathematicians, physicists, refinery and automotive technologists, engine and fuel rating specialists. There are also electrical engineers whose chief job is to develop instrumentation for measuring and recording transient phenomena. Together, these men make up a well coordinated research team with extensive training and experience in the field of combustion.

Results available

The research results developed by this team are made readily available to the whole refining industry. They are published periodically in papers presented to scientific organizations and industry technical associations.

Write us for more information about this program or published results of our automotive research work.

You ought to know...

ALFRED R. MULLIS is Assistant Director of Sales of the Petroleum Chemicals Division. Prior to this assignment, he was manager of the Division's Eastern Region with headquarters in New York.

Mr. Mullis joined the Du Pont Company in 1947 as a sales representative in the Gulf Coast Region. He was appointed manager of this region in 1951 and transferred to New York the following year.

Mr. Mullis is a graduate in chemical engineering from Rice Institute. His first job was on the research and development staff of a large refining company. During World War II, Mr. Mullis spent four years in the Navy as a petroleum inspector for the Bureau of Ships.

When he was promoted by Du Pont to Assistant Director of Sales, Mr. Mullis succeeded Mr. W. Sam Carpenter, III who became Director of Sales. Mullis's former position as manager of the Eastern Region was filled by Earl G. Bennett, formerly manager of the Central Region with Chicago headquarters. Mr. Bennett was succeeded by Donald W. Frison, formerly manager of the Mid-Continent Region, with headquarters in Tulsa.

HOW Du Pont DMF Antistall Additive prevents carburetor-icing

When vaporizing in a carburetor, gasoline absorbs heat from its surroundings. This cools the metal parts of the carburetor and the water vapor in the air which is drawn into the carburetor.

This cooling process causes the moisture to condense and freeze when the atmospheric temperature is anywhere in the range from 22 to 55°F. – and when the relative humidity is 65% or more. Ice then forms in the carburetor causing the engine to stall from fuel starvation.

Du Pont DMF protects the motorist against annoying stalls by preventing the formation of ice in carburetors. The DMF does this by lowering the freezing point of the condensed water in the carburetor to well below 32°F. This action is positive and unfailing.

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ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

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J&L FOR MOTORS

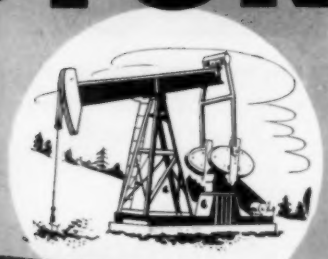
. . . 1/8 to 400 HP

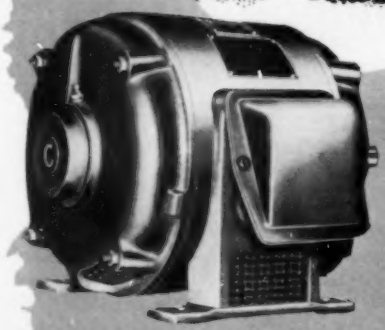
If you have a job for an electric motor get your J&L store on the 'phone.

Tell us about the job and we'll tell you about a Century Motor with the power, the characteristics, and the experience to handle it.

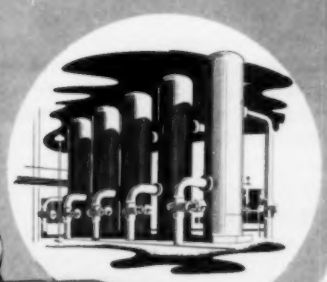
Century specializes in tough electric motors for exacting oil country jobs and J&L Supply men understand their application. If the job is technical we'll work with your engineers, or we'll supply the engineering know-how.

Just get your J&L store on the 'phone.





Century Weathergard high torque, high slip motors start and handle pumping units with quiet efficiency in any weather your forecaster can dream up.



Century explosion-proof motors protect life and property wherever an electric spark might be disastrous.

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SUPPLY DIVISION – Tulsa

J&L – A GREAT NAME IN SUPPLIES

1-MA

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Prewashing of Refinery Gas Stream Reduces Diethanolamine Fouling

Gas sweetening cost reduced by preventing contamination

Most refinery gas treating plants using diethanolamine to remove hydrogen sulfide have operated for years with little trouble. However, there have been some instances where the solution has rapidly become fouled.

Laboratory analyses and actual field investigations have revealed that the formation of heat-stable salts is frequently a major contributor to solution fouling. Research has further shown that the formation of these salts can often be controlled by prewashing the gas stream. CARBIDE's Technical Service Department has helped achieve maximum operating economy for many ethanolamine users.

THE EXISTENCE OF HEAT-STABLE SALTS

Estimates of diethanolamine losses in treating operations are based on the observation that the solution progressively declines in capacity to accept acid gases. Analytic procedures suggest that the diethanolamine is not being physically lost from the system by leakage, vaporization or entrainment, but is being converted to heat-stable salts. Examination of many used diethanolamine solution samples from customers' plants has confirmed the presence of heat-stable salts of organic acids such as formic and acetic.

$$DEA + HCOOH \longrightarrow DEA \cdot HOOCH$$

$$DEA + CH_3COOH \longrightarrow DEA \cdot HOOCCH_3$$

THE FORMATION OF OTHER SALTS

In some cases, hydrogen cyanide also enters the treating plant in the gas stream and is combined with diethanolamine as a soluble salt in the absorber section, as are carbon dioxide, hydrogen sulfide, and other acidic components. Analyses of used plant solutions has confirmed the presence of ferrocyanides. It appears likely that they are formed by one or both of the following reaction routes.

1. $Fe(HCO_3)_2 + 6\ DEA \cdot HCN \longrightarrow 2DEA \cdot HCO_3 + (DEAH)_4Fe(CN)_6$

2. $Fe + 2H_2O \longrightarrow Fe(OH)_2 + H_2$

$$Fe(OH)_2 + 2HCN \longrightarrow Fe(CN)_2 + 2H_2O$$

$$Fe(CN)_2 + 4HCN \longrightarrow H_4Fe(CN)_6$$

$$H_4Fe(CN)_6 + 4DEA \longrightarrow (DEAH)_4Fe(CN)_6$$

PREVENTION OF SALT FORMATION

It is possible to minimize the contamination of amine solutions from organic acids by prewashing the gas stream with an alkali solution or water.

In an alkali prewash, some of the caustic will be converted quickly to sodium acid sulfide and sodium sulfide (or the corresponding carbonate salts) by the hydrogen sulfide (or carbon dioxide) in the gas. Nevertheless, the solution will still remove formic and acetic acids since these stronger acids will replace the weaker sulfides and carbonates.

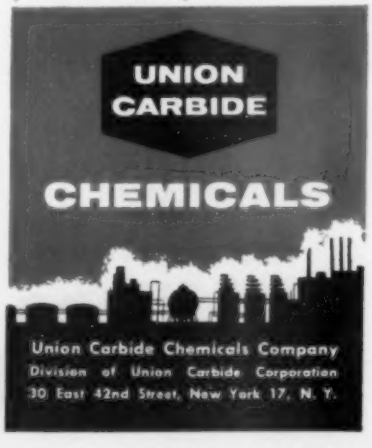
Caustic solutions may not be as effective in removing hydrogen cyanide as they are in removing formic and acetic acid from gas streams rich in hydrogen sulfide or carbon dioxide. This is because the sulfides and carbonates replace the weaker cyanides. The high water solubility of hydrogen cyanide (and the relatively low solubilities of hydrogen sulfide and carbon dioxide) makes water washing an alternate method of hydrogen cyanide removal.

Prewashing not only reduces fouling of the diethanolamine but is also beneficial because the contaminants that are removed may sometimes promote corrosion.

FURTHER STUDIES

Union Carbide Chemicals Company is continually engaged in research designed to improve the products and processes of the gas conditioning industry. The results of this research are readily available to the industry from CARBIDE's Technical Service Department. If you would like more information on CARBIDE's Technical Services to the gas treating industry, call our nearest technical representative or write, Union Carbide Chemicals Company, Room 328, Department B, 30 East 42nd Street, New York 17, New York.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation



NEW! direct tank-mounted LIQUID LEVEL TRANSMITTER

Exclusive static pressure connection for closed vessels above or below atmosphere . . . eliminates need for second instrument.

This sensing diaphragm capsule flange-mounts directly on side of tank. All wetted parts of Type 316 stainless steel, with optional plastic coating for further corrosion protection.

with DIRECT 3-15 psi air output signal

IDEAL FOR: Viscous or corrosive fluids, slurries, and solids-in-suspension, as well as "easy-to-measure" fluids.

Now you can measure the level of "difficult" or easy-to-measure fluids — economically, without the complication of floats or bubble tubes, and with *sustained high accuracy over the entire range span.*

Flange-mounted directly to the side of an open or closed tank, the Type 13FA Transmitter eliminates piping and purging. Its stainless steel diaphragm capsule senses level changes instantly. Conventional tubing leads its output air signal directly to standard 3-15 psi receiver-recorders and controllers without need for intermediate signal converters.

The 13FA provides an accurate, trouble-free solution for level measurement problems. Write for detailed information, or ask your nearby Foxboro Field Engineer to explain its application to your specific process.

The Foxboro Company, 602 Neponset Ave., Foxboro, Mass., U.S.A.

FOXBORO

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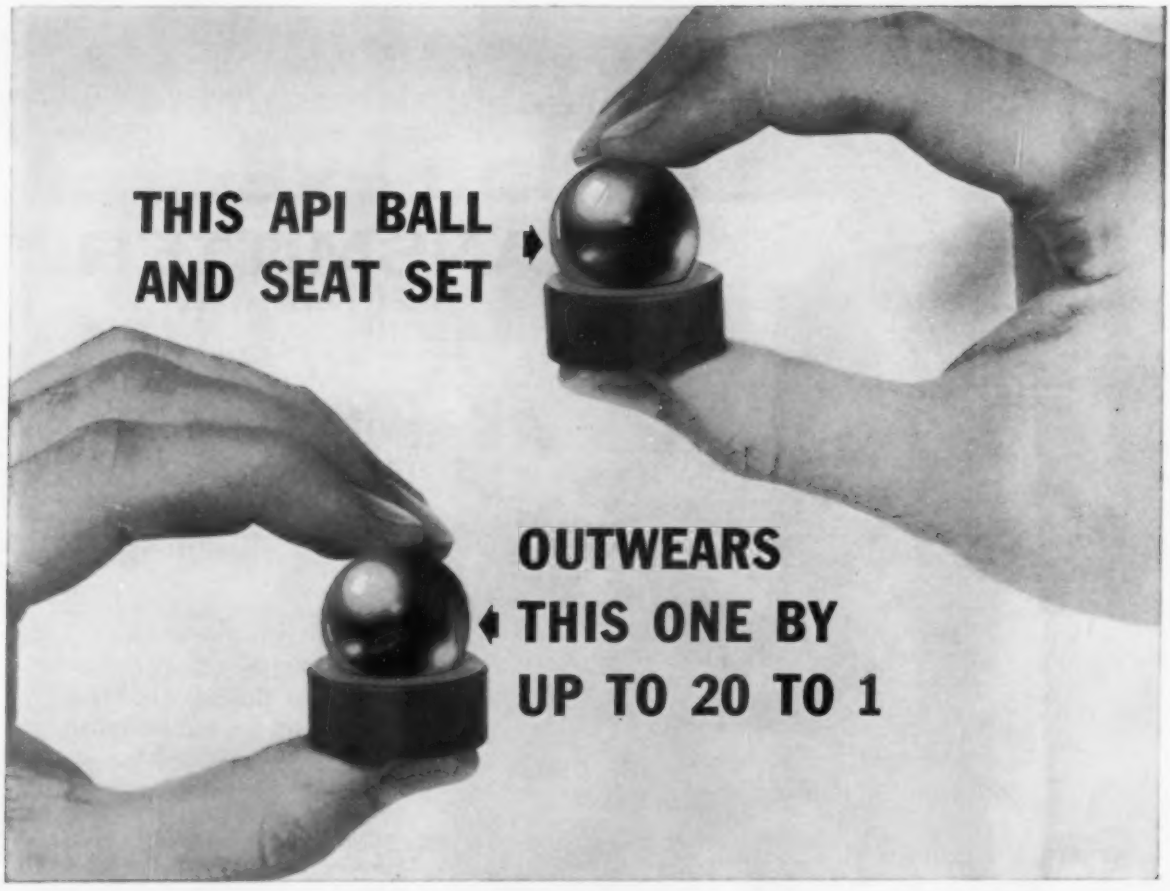
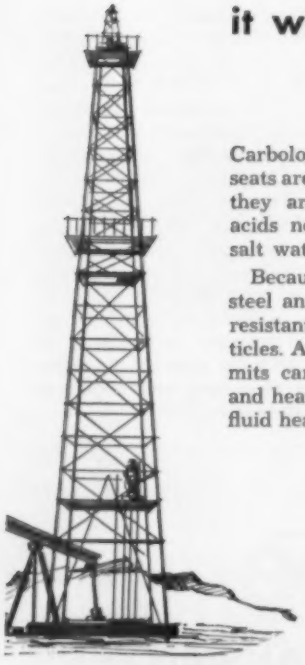
LIQUID LEVEL TRANSMITTERS



It's Carboloy® cemented carbide . . . and here's why it withstands the sand, sulfur, acid and impact that quickly ruin even hardened stainless steel



Carboloy cemented carbide API balls and seats are ideal for sub-surface pumps because they are practically inert to corrosion by acids normally found in oil and gas. Even salt water does not measurably affect them.

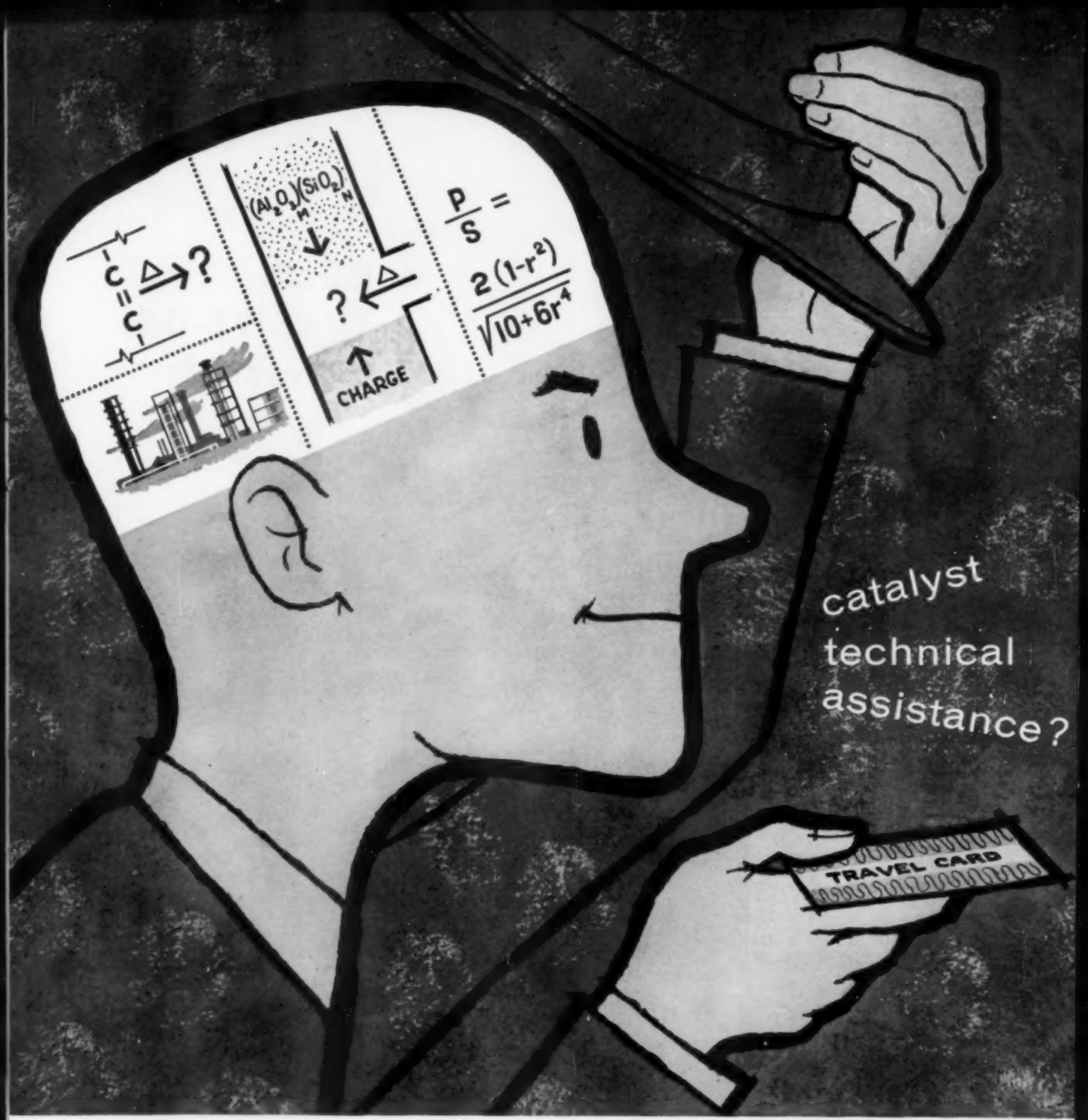
Because carbide is harder than the hardest steel and takes a high polish, it is far more resistant to abrasion by sand and other particles. And its greater impact resistance permits carbide to withstand severe pounding and heavy loads caused by the weight of the fluid head.

Carboloy cemented carbide balls and seats outwear even hardened stainless steel by up to 20 to 1. Because they stay on the job longer, you can reduce pulling and service costs . . . maintain continuous production.

When ordering from your supplier, be sure to specify Carboloy balls and seats. They're available for immediate delivery in standard API sizes. For more facts, write: *Metallurgical Products Department of General Electric Company, 11181 E. 8 Mile Ave., Detroit 32, Michigan.*

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC



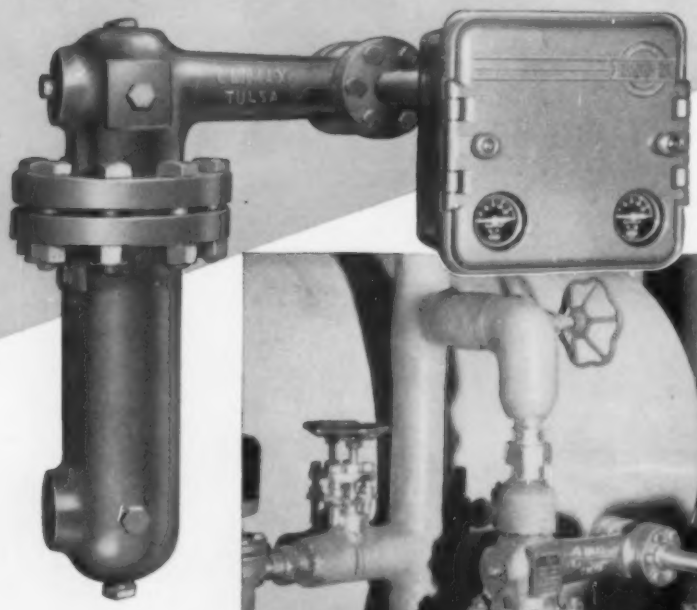
The Man from Davison is quick with a travel card, quick with your answer

The Man from Davison will go anywhere any time. He's worked in advisory capacity on hundreds of complex petroleum catalyst jobs. He is best qualified to help you arrive at the most practical and economical answer to your catalyst needs. He's ready to put his experience and knowledge to work on your problem. He's available at once.

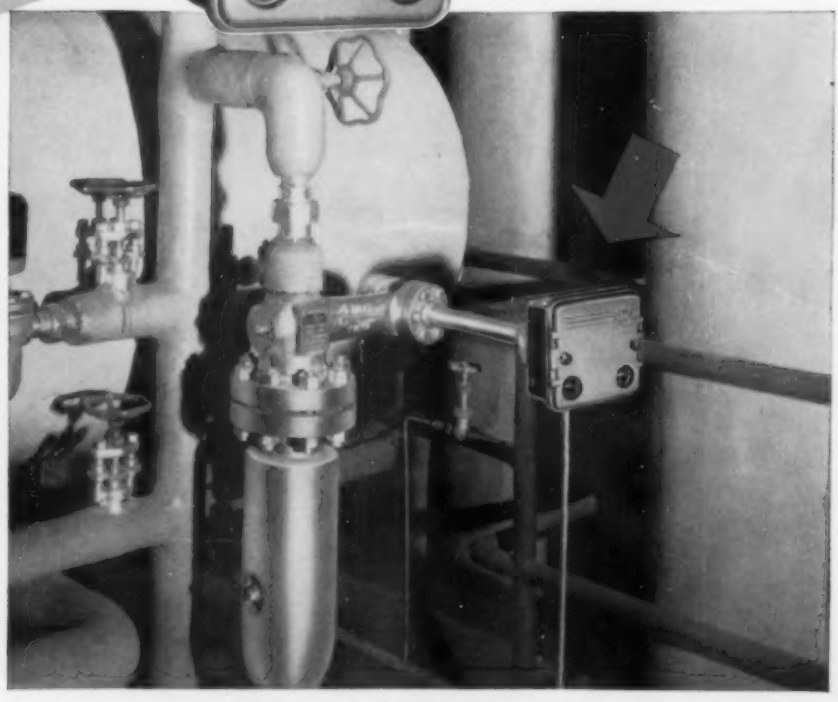
DAVISON
CHEMICAL COMPANY
Division of W. R. Grace & Co.
Baltimore 3, Maryland

Buy DAVISON—the quality catalyst backed up by experience, research, technical assistance, service!

When An External Cage Type Liquid Level Controller Is Indicated, Specify The . . .



BS&B Type 71-06, Series 2!



OVER 60 YEARS BS&B ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

1. **"Built In" Accuracy:** Engineered to control within close level tolerances.
2. **Rugged:** Capable of continuous operation under severe service conditions.
3. **Versatile:** May be either transmitter or controller. Set for differential-gap, on-off, or proportional control. Controller output range in 3-15, 3-27 and 6-30 psig.
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For Complete Information On The BS&B Type 71-06, Series 2, Or Other BS&B Liquid Level Controllers, Contact Your BS&B Sales Engineer — or Write To . . .

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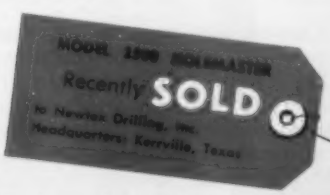
Drillers everywhere are SOLD on Failing Rigs and Failing Service

EARMARKED for slim hole production drilling by the Graybol Oil Corporation, this FAILING MODEL 90 Portable Slim Hole Rig is used by drilling contractors and major oil companies for its economy and efficiency in petroleum production and for stratigraphic exploration. On land — and off-shore, too — the MODEL 90 has established an enviable record for mobility, rapid rig-up and tear down . . . with no sacrifice in strength, performance and flexibility.

WHETHER for production drilling, core drilling, shot hole drilling, or other activities...FAILING rigs are serving more and more drilling contractors and major oil companies around the globe. Not only do FAILING rigs deliver more quality features per dollar invested — but strategically located FAILING branch stores provide efficient service for nearly every section of the country in which there is drilling activity. Let us show you how FAILING rigs fit into your drilling picture for greater drilling profits in 1958.

NOW BEING USED for core drilling in connection with the development of Mexico's petroleum industry, the 1500 Holemaster is available in 3 models with different power and drive arrangements. Simplified, grouped controls; draw works unitized with drillhead.



USED for production drilling by the Newtex Drilling Company, this 2500 Holemaster is a truck or trailer mounted rig, ideal for slim hole production drilling, deep exploration and water well drilling. Not affected by climate, the 2500 Holemaster is being used successfully in the far northern countries as well as the hot desert areas of Egypt and Africa.

GEORGE E. FAILING COMPANY

GEORGE E. Failing COMPANY

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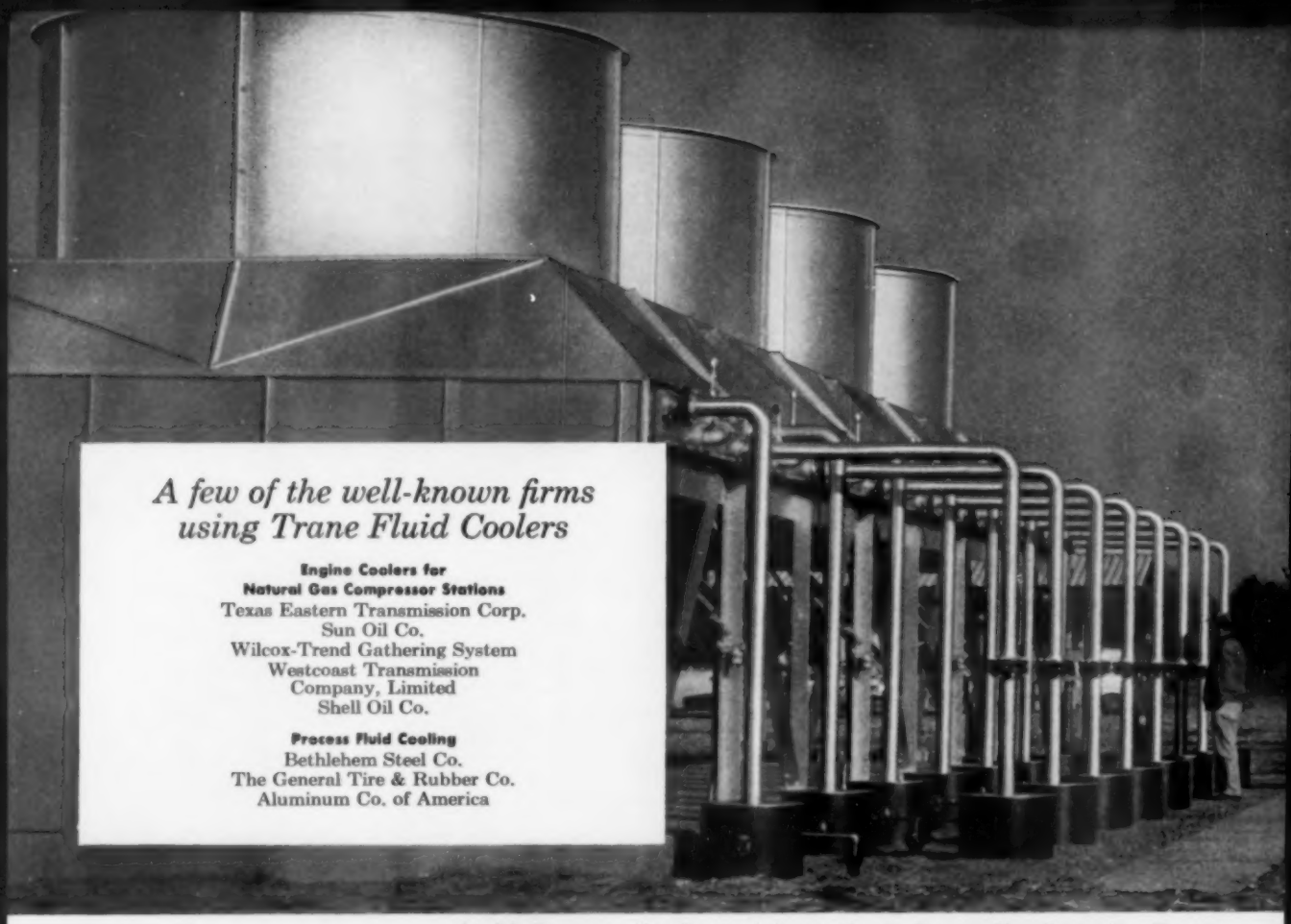
FAST SERVICE ON ORDERS FOR SPARE PARTS FROM ALL FAILING BRANCH STORES IN THE UNITED STATES AND CANADA. SERVICE MEN AT ALL STORE POINTS.



A few of the well-known firms using Trane Fluid Coolers

Engine Coolers for Natural Gas Compressor Stations

Texas Eastern Transmission Corp.
Sun Oil Co.
Wilcox-Trend Gathering System
Westcoast Transmission Company, Limited
Shell Oil Co.

Process Fluid Cooling

Bethlehem Steel Co.
The General Tire & Rubber Co.
Aluminum Co. of America

At this Tennessee Gas Transmission station in Clymer, New York, four TRANE

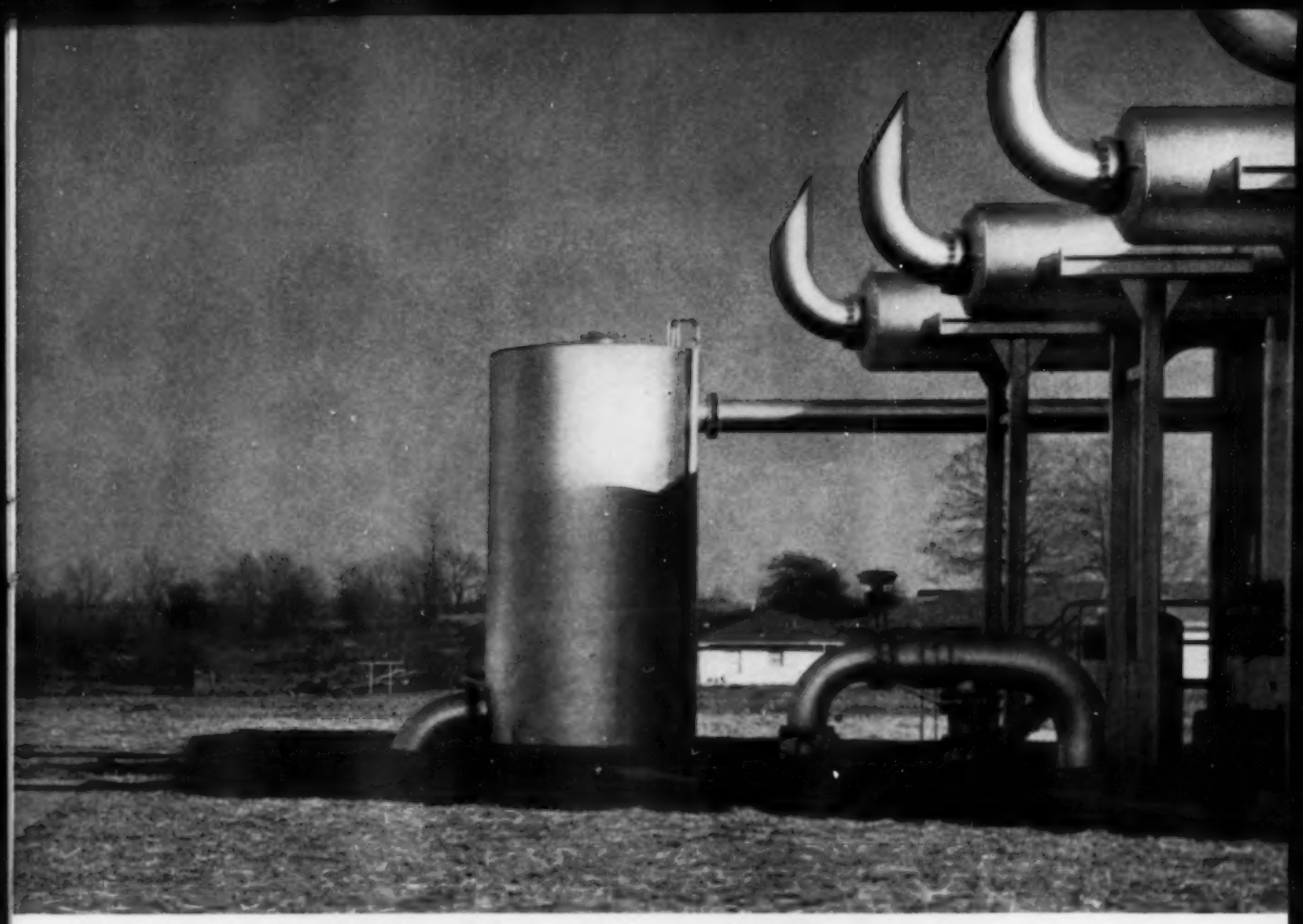
Tennessee Gas installs Trane

Induced draft units erected, tested and run-in at Trane laboratory before shipment

At Tennessee Gas Transmission Company's Clymer, New York station, four induced draft TRANE Fluid Coolers were installed to cool jacket water for four 2000 hp gas engine compressors. Before these units were shipped, they were erected and tested in the TRANE laboratories. Here, engineers were able to check all aspects of a prototype unit's performance—freedom from vibration, uniformity of air distribution through the heat transfer section, and every detail of workmanship and construction.

More and more major pipeline transmission companies are turning to TRANE for their fluid cooling equipment. Many have reported that TRANE Fluid Coolers are rugged, dependable, simply designed—with a minimum of maintenance and adjustment problems. And, with TRANE Fluid Coolers, engineers know that they can depend upon the accuracy and completeness of the capacity ratings. These ratings are based upon the industry's most complete laboratory testing—plus many years of field experience. Unlike many manufacturers, TRANE makes all its own coils—has had thirty years of experience in this highly specialized field.

When you have a fluid cooling problem, turn to TRANE! Call your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

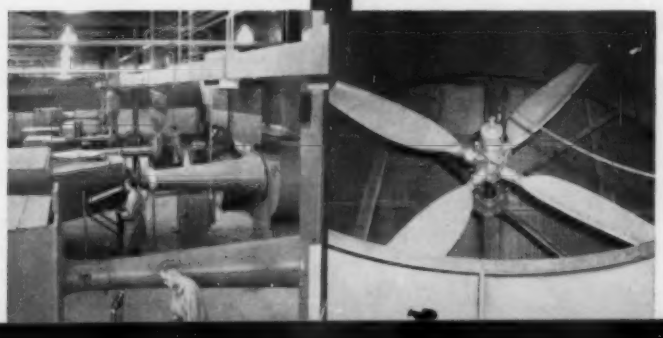


Fluid Coolers are used to cool jacket water for four 2000 hp gas engine compressors.

Transmission Co. Fluid Coolers

Wind tunnel room in TRANE laboratory—"The House of Weather Magic"—where as many as ninety different temperature readings are taken across the face of a heat transfer section. In this laboratory, complete testing facilities are available to provide the data for rating the performance of every piece of equipment. Here, too, new TRANE products are developed and tested.

Controllable pitch propeller assemblies were supplied for this installation. Automatically hold fluid outlet temperatures to plus or minus 2°. Have fewer moving parts, bearings, controls . . . cut power costs as much as 50%. Fan, motor and drive are factory-aligned on a single metal base to cut installation time. All framework parts are pre-drilled and match-marked.



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MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

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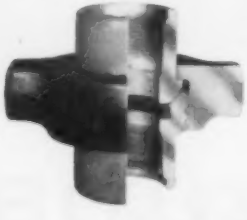
Hurry up!



YOU DON'T HAVE TO BABY WECO UNIONS

Your rigging-up goes at top speed when you've got WECO on the job. High grade steel, forged into strong subs and nuts enables WECO Unions to take the rough handling of fast make-up on job after job. Positive action of WECO's full circle ball and cone metal-to-metal seating provides perfect sealing under all service conditions.

You never have to worry about high-pressure, shock, surge or vibration breaking the seals on your WECO equipped piping.

WECO Unions are available at supply stores everywhere, in sizes 1″ through 12″, in pressures from 1,000 through 15,000 psi.

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WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

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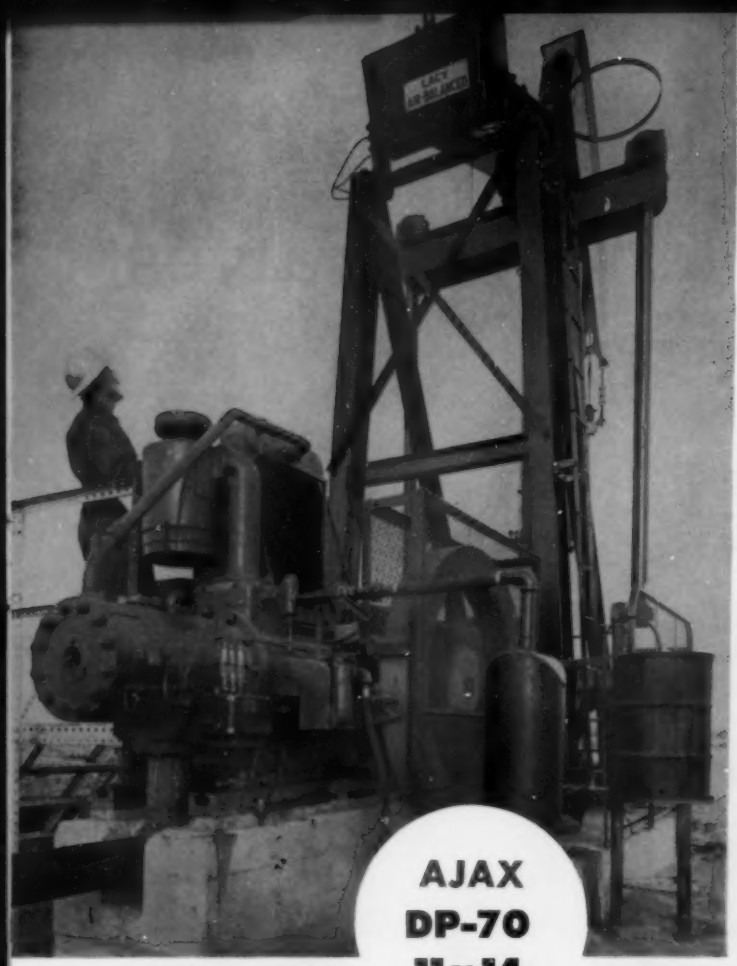
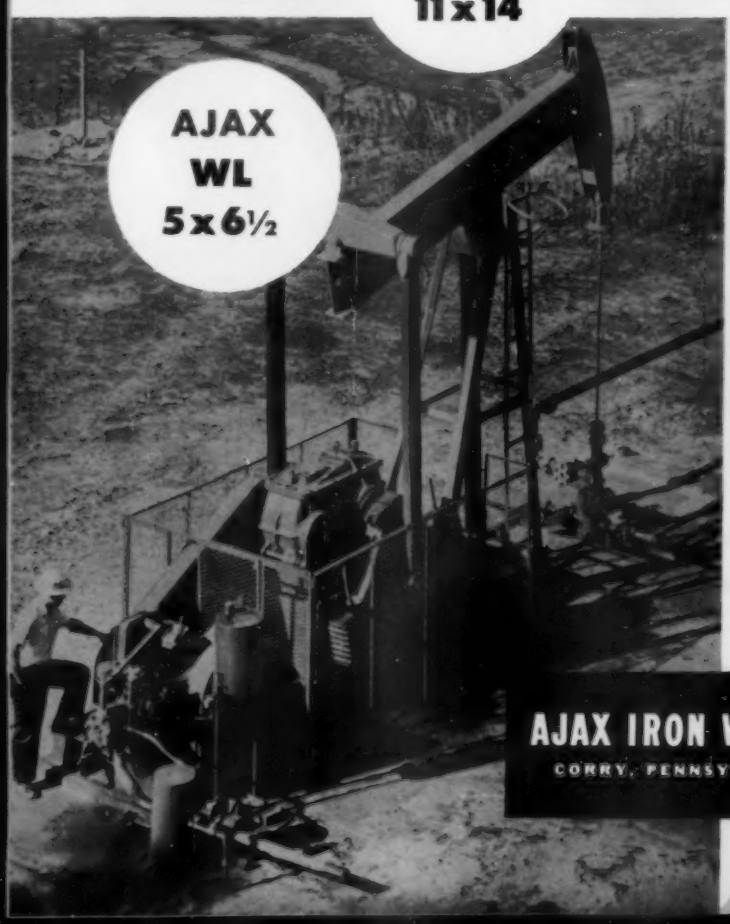


AJAX
DP-70
11x14



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IN

Ajax ENGINES

LARGE or SMALL—

The payoff is in the performance

AJAX Gas Engines make money by the day because they cost less to run by the hour —and they pay for themselves every two or three years! This is the kind of performance only AJAX *and gas* can deliver.

• You owe it to your pocketbook to get the actual facts. Your Supply Man has the figures you need covering the complete range of AJAX Gas Engines—ask him to present them, promptly.

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CORRY, PENNSYLVANIA

Builders of **GAS AND OIL ENGINES, PRESSURE PUMPS, STEAM ENGINES**

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world's largest family of valves

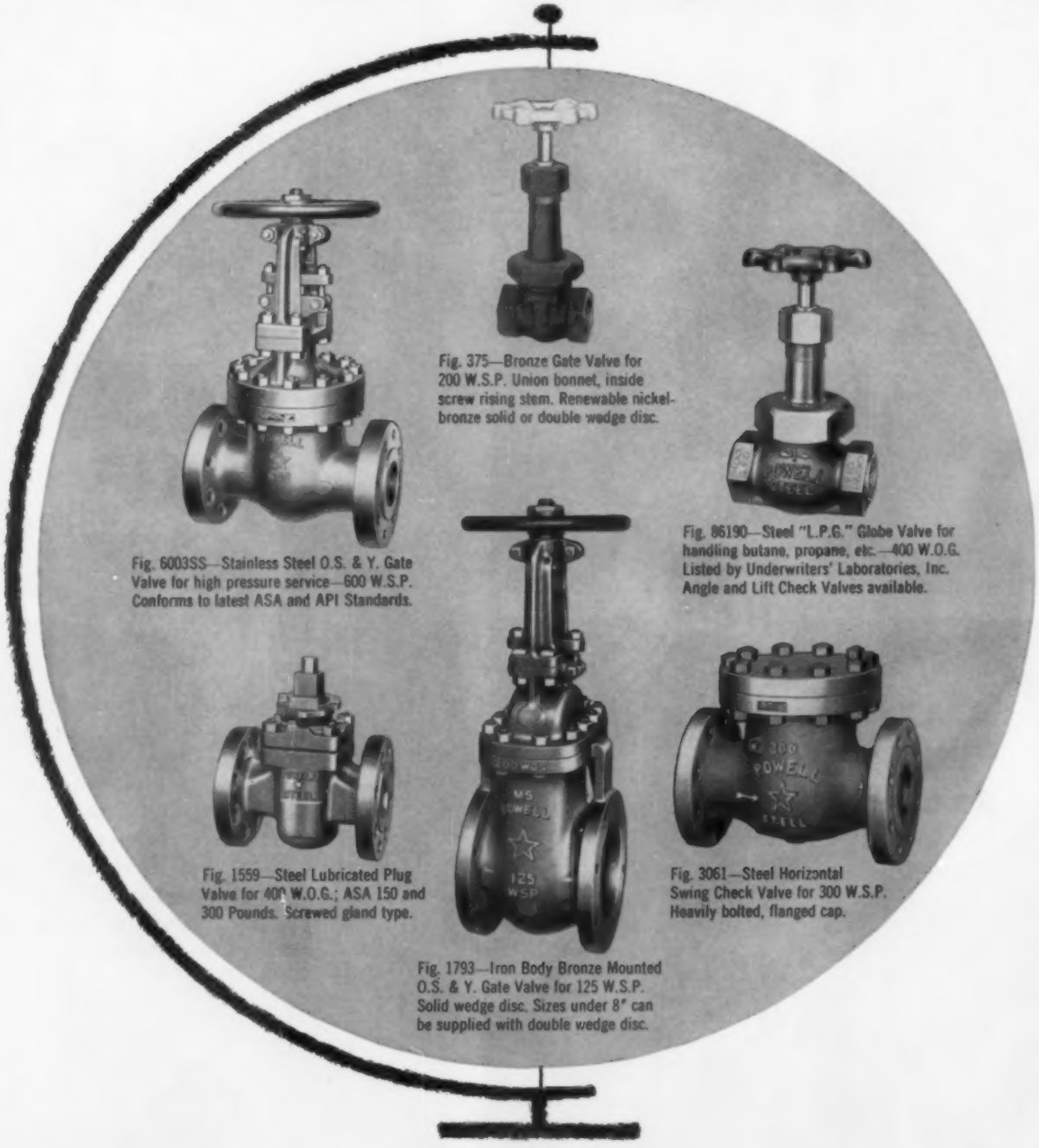


Fig. 375—Bronze Gate Valve for 200 W.S.P. Union bonnet, inside screw rising stem. Renewable nickel-bronze solid or double wedge disc.

Fig. 6003SS—Stainless Steel O.S. & Y. Gate Valve for high pressure service—600 W.S.P. Conforms to latest ASA and API Standards.

Fig. 86190—Steel "L.P.G." Globe Valve for handling butane, propane, etc.—400 W.O.G. Listed by Underwriters' Laboratories, Inc. Angle and Lift Check Valves available.

Fig. 1559—Steel Lubricated Plug Valve for 400 W.O.G.; ASA 150 and 300 Pounds. Screwed gland type.

Fig. 1793—Iron Body Bronze Mounted O.S. & Y. Gate Valve for 125 W.S.P. Solid wedge disc. Sizes under 8" can be supplied with double wedge disc.

Fig. 3061—Steel Horizontal Swing Check Valve for 300 W.S.P. Heavily bolted, flanged cap.

FOR EVERY FLOW CONTROL PROBLEM Powell offers more kinds or types of valves, available in the largest variety of metals and alloys, to handle every flow control requirement. Your local valve distributor will be glad to tell you all about them. Or write to us for the full facts.

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

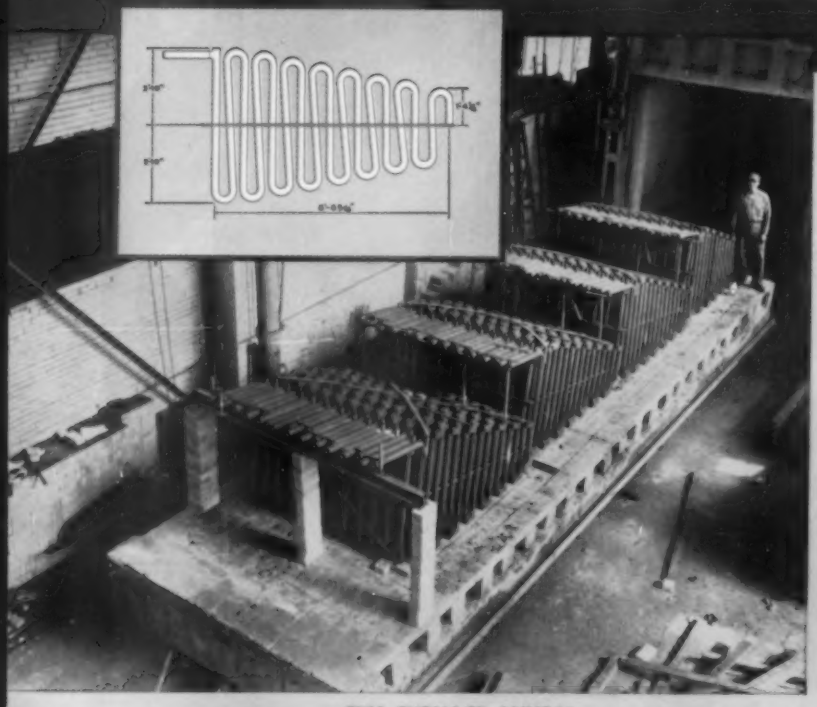
75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

MIDWEST PIPE COILS

Meet the MOST EXACTING Specifications



FULL FURNACE ANNEAL

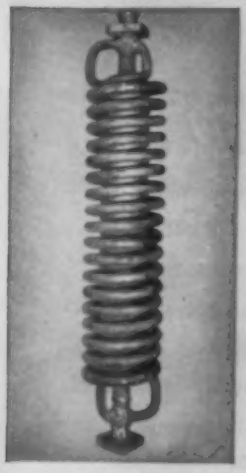
Furnaces of giant size enable us to anneal large coils under closely controlled conditions. Shown here is set of 48 kiln cooling coils 2⅜" OD x .165" wall bent on 6" centers with maximum reduction of ⅛" on OD. Material is 7% Cr—½% Mo.

Do you need coils

- . . . that are full furnace annealed
- . . . of intricate design
- . . . to comply with codes
- . . . with bends to close centers
- . . . to accurate dimensions
- . . . made of stainless steel or other corrosion resistant or heat resistant pipe?

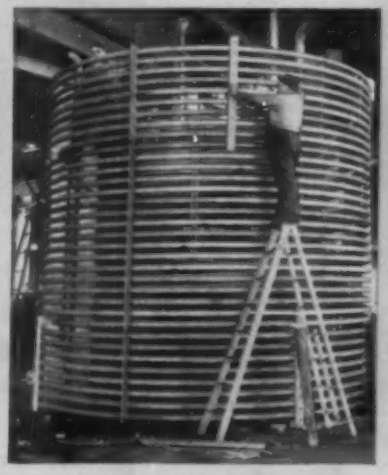
We make coils of any size, shape or contour . . . of any pipe which can be bent and welded. Equipment includes the most modern bending and coiling machines . . . furnaces large enough for full furnace anneal. Welding and coiling techniques are the most advanced, developed through long experience.

Here are just a few of the types of coils we make regularly. Send us your specifications.



DOUBLE COIL

Diameter of inside coil is only 8" while outside is 14". Made of 1⅜" OD x 1⅛" ID 4-6% Cr—½% Mo tubing and full furnace annealed.



304 STAINLESS-SANITARY FINISH

Double cylindrical coil of 3" OD by 14 gauge, Type 304 stainless steel. All welds ground to sanitary finish.

KETTLE COIL

Made of 1" Schedule 40—316 ELC. Finished coil was heated to 1950°F and water quenched.

7677

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GUIBERSON'S TYPE H4 *Hydraulic Anchor*

TYPE H4 ANCHOR

with MORE FLUID BYPASS

The channeled body H4 Anchor gives you four operational improvements — faster going in, better circulation in the hole, faster pulling out and simpler clean-up.

Completely automatic in operation, the H4 incorporates a body designed for unusually large bypass area and tremendous holding power. It has a husky fishing connection on top. Case hardened piston slips are retained by a stainless snap ring that holds the slips in retracted position while going in or pulling — keeps the slips from dragging on the casing wall.

We recommend the H4 for holding down production-type packers in acidizing, fracturing or other below packer pressuring operations. The H4 not only improves circulation, but speeds up operations and cuts down maintenance costs.

Guiberson H4 Anchors are individually tested and available in a full range of casing sizes.

THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
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Sold by
Oil Field Supply Stores
Everywhere

Little Things Produce Big Results

...like Wheatland Steel Pipe Quality

A little thing—a finger in a dike—once accomplished so much. Today at the Wheatland mill, it's the *small* detail, done well, that produces finer quality steel pipe—formable, weldable, durable and strong—the kind of pipe *you* want for *your* installations.

...pipe with the yearmark!

For information about Black or Galvanized Steel Pipe, contact

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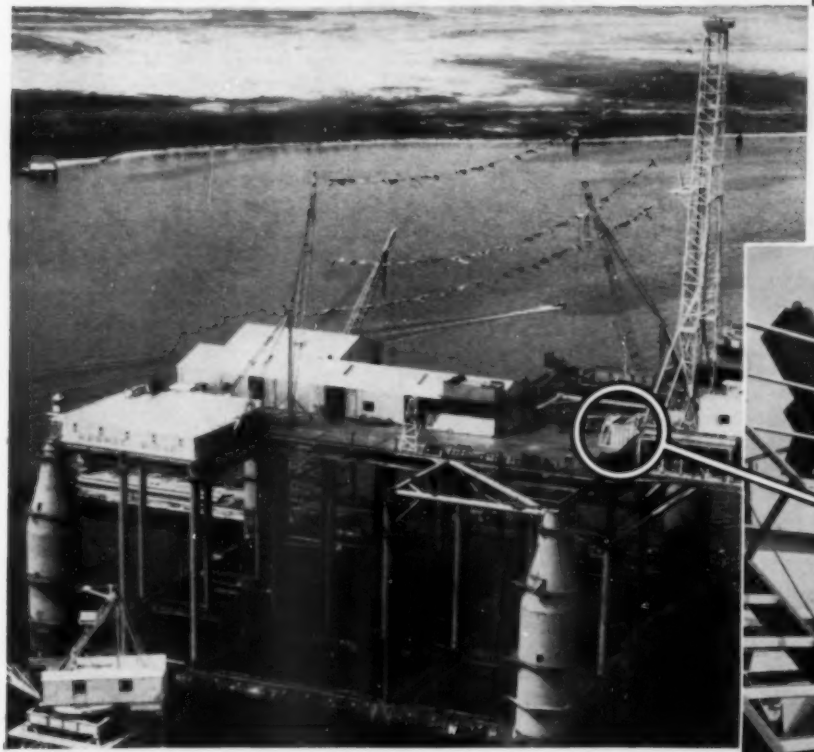
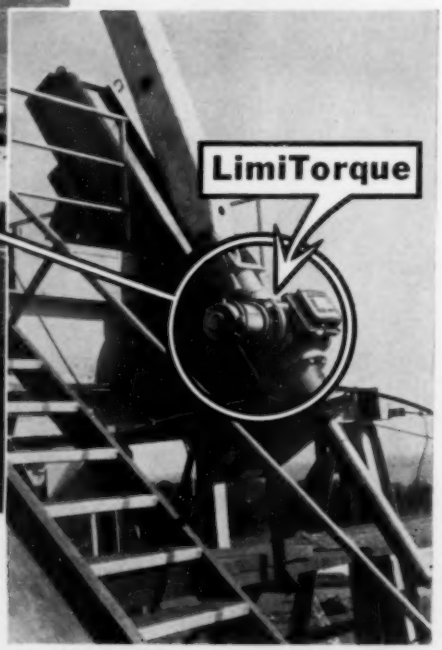
BANKERS SECURITIES BUILDING, PHILADELPHIA 7, PA.

MILLS: WHEATLAND, PA. • DELAIR, N.J.

API LINE PIPE IN ACCORDANCE WITH AMERICAN PETROLEUM INSTITUTE SPECIFICATIONS

LimiTorque ACTUATORS ENABLE DRILLING MAST TO SERVE AS CONSTRUCTION BOOM . . . . . on "KERMAC" RIG 46, SUBMERSIBLE BARGE





Jacks on derrick legs, electrically operated by LimiTorque actuators, allow the mast to be tilted for use as a construction boom, which can pick up 250,000 lbs. from the water.

Kerr-McGee Industries' modern Rig 46 Submersible Barge is the widest and longest mobile offshore structure yet built . . . width 202 ft., length 242 ft., and when floating with its Drilling Mast up, it is the tallest floating structure of any kind anywhere—from bottom of base to top of Drilling Mast it is 268 ft. high. The use of two LimiTorque Motorized Actuator Units permit the Drilling Mast (designed by IDECO) to "tilt", and thereby act also as a Construction Boom. Construction of this unique Submersible Barge was done at the Ingalls Shipbuilding Corporation, Pascagoula, Miss. . . . Rig 46 is entirely self-contained and is towed to location by tugs.

THIS APPLICATION OF LIMITORQUE LINEAR POSITIONING CONTROLS IS UNIQUE AND EFFECTIVE—AND MAY SERVE AS A SUGGESTION FOR OTHER USES IN THE PETROLEUM INDUSTRY.

LimiTorque Motorized Linear Positioning Actuators and Valve Operators are backed by 30 years experience; they are highly efficient and absolutely dependable.

Send for catalog L-550

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

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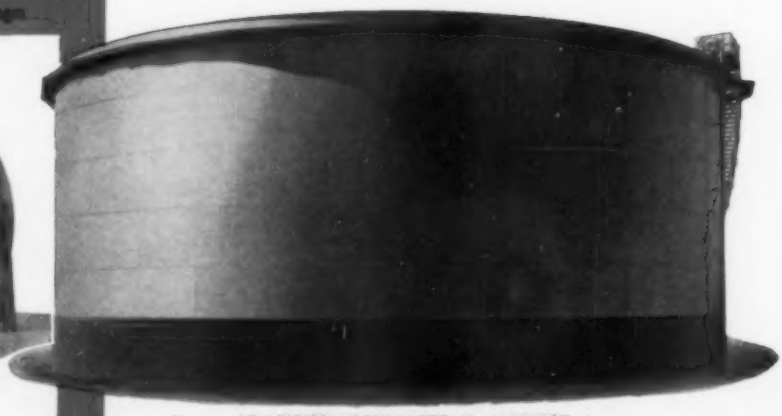
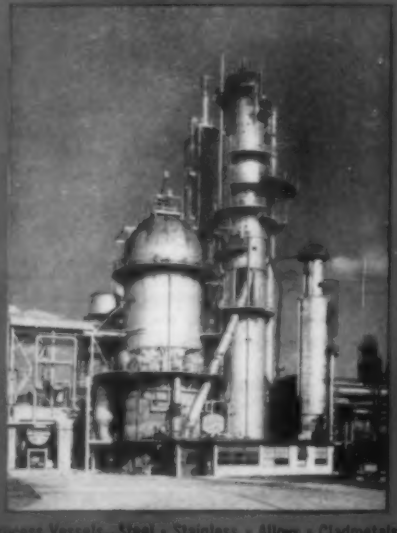
STORAGE TANKS and PLATE FABRICATION

BIALIST* tank with vapor-saver diaphragm

Hammond Spheres

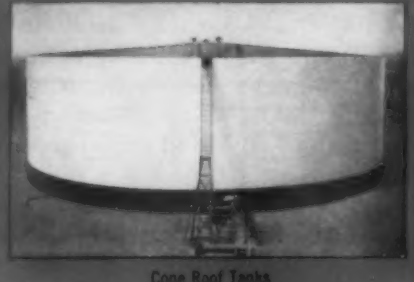


Hammond **TUBESEAL*** and **SPRINGTITE*** Floating Roof Tanks



Process Vessels—Steel • Stainless • Alloys • Cladmetals

Water Storage Tanks



Cone Roof Tanks

The universal acceptance of Hammond-built equipment is the result of more than half a century of experience in the design, fabrication and erection of storage tanks, process vessels and steel plate construction for the petroleum, chemical and allied industries, and for water supply.

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HAMONDTANK

JEFFERSON

GAS-SCRUBBING AGENTS

. . . are ready to roll by tank car or tank wagon from nearby shipping points.

MONOETHANOLAMINE **DIETHYLENE GLYCOL**
DIETHANOLAMINE **TRIETHYLENE GLYCOL**

for:

Natural Gas Sweetening
Refinery Stream Sweetening
Sulfur Recovery
Gas Dehydration
Carbon Dioxide Absorption

Bulk shipments range from 1,000 to 4,000 gallons in tank wagons; from 4,000 to 10,000 gallons in tank cars.

Jefferson's compartmented tank wagons and tank cars permit combination shipments of smaller amounts—reducing storage requirements and inventory problems.

Call your Jefferson office for further details on the use of monoethanolamine, diethanolamine, diethylene glycol and triethylene glycol in your gas-scrubbing applications.
Jefferson Chemical Company, Inc.,
1121 Walker Avenue,
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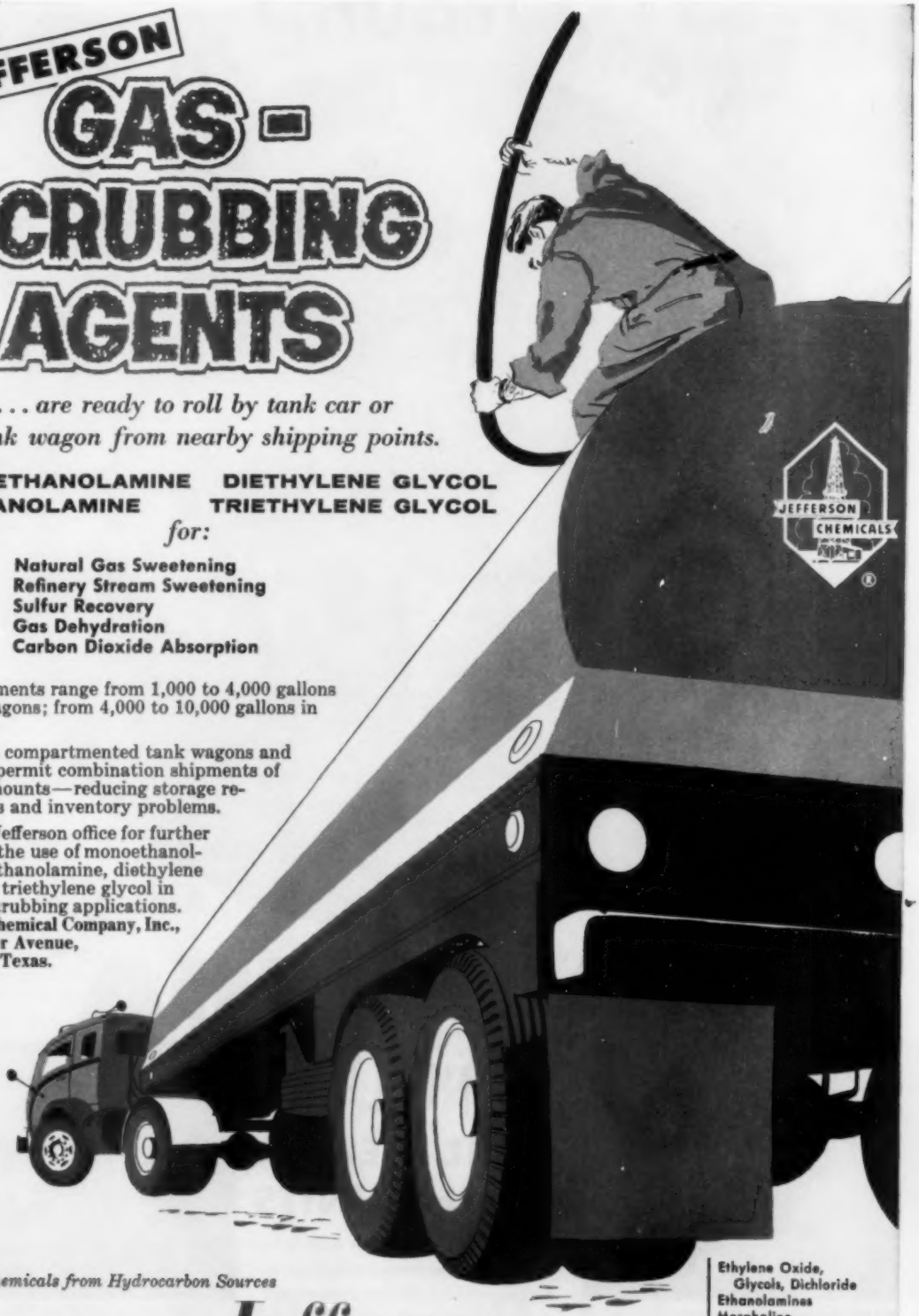

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Agents—N Series and
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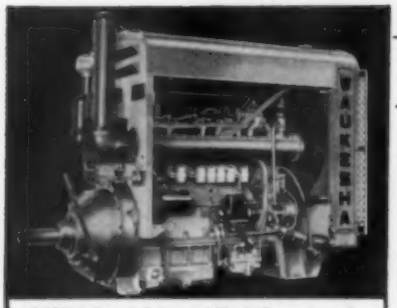
'round and 'round the clock

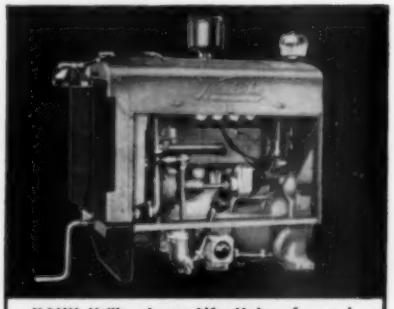
WAUKESHA

LONG LIFE OIL FIELD POWER UNITS



WAKU Special Long Life Unit—six cyl., 6¼-in. bore x 6½-in. stroke, 1197 cu. in., 125 continuous (65%) hp at 1200 rpm.

Features and accessories built into these special gas units enable them to operate without maintenance except at greatly extended intervals. Make big savings in pumping; compressor service; and feeder operations.

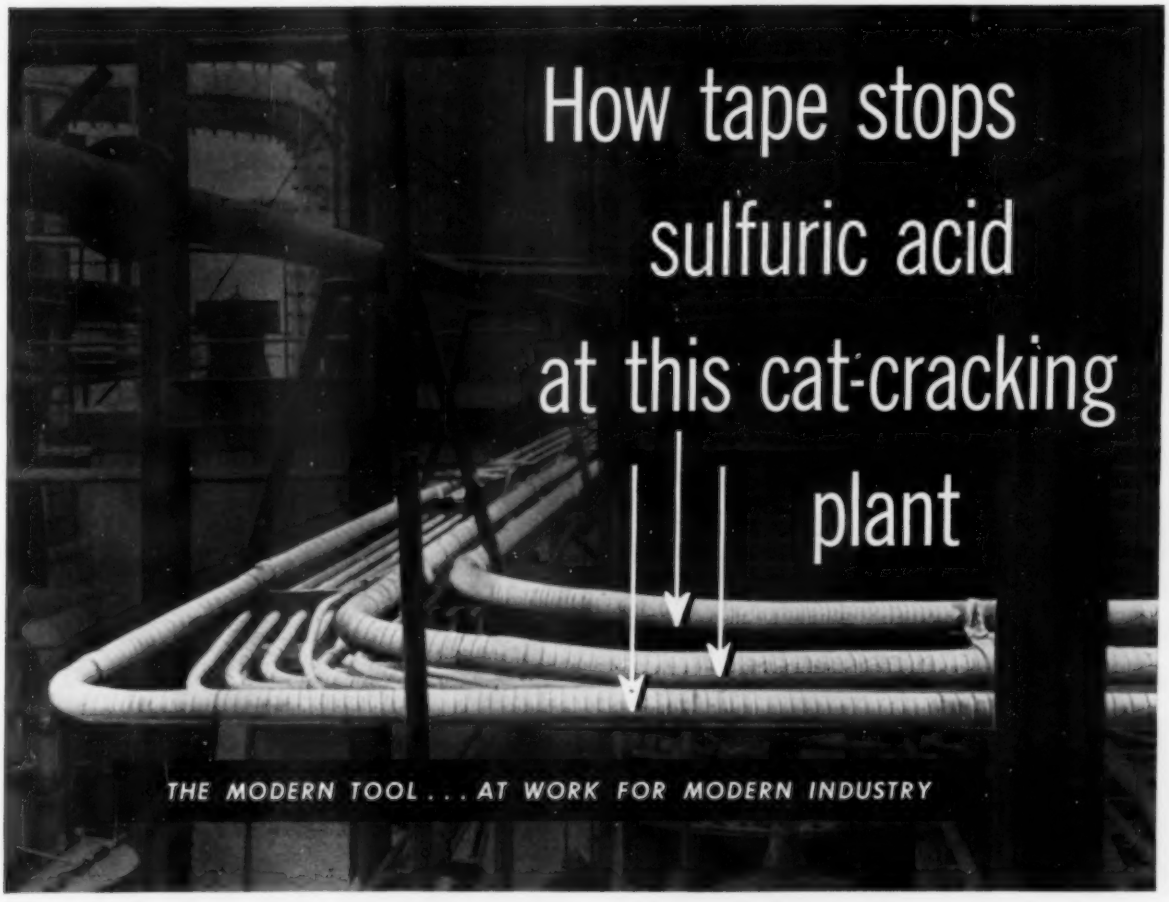


XAHU Utility Long Life Unit—four cyl., 3⅜-in. bore x 4½-in. stroke, 186 cu. in., 21 continuous (65%) hp at 1500 rpm.

365-9

Sizes range from 133 to 1197 cu. in.—14 hp at 1500 to 124 hp at 1200 rpm continuous duty ratings (65% of max. hp). For details get Bulletin 1702.

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN • New York • Tulsa • Los Angeles



FIVE YEARS UNDER THESE HIGHLY CORROSIVE CONDITIONS PROVES THAT POLYKEN PROTECTION WORKS . . . *TO TRIM COSTS*

Look in on one of the world's largest fluid catalytic cracking units. A maze of conduit and pipe exposed to an extremely corrosive sulfuric acid atmosphere.

Formerly, these structures had to be painted every three or four months. Maintenance costs were excessive. Then, five years ago, they were wrapped with Polyken Protective Tape Coating. They have needed practically no attention since.

INERT POLYETHYLENE

The reason is that Polyken takes amazingly inert polyethylene and makes it into a tape coating with all these properties.

- **tough and elastic**
- **unplasticized, non-drying film**
- **doubly thick adhesive to seal all voids**
- **far higher adhesion for a true bond to pipe surface**
- **lower water vapor transmission rate**
- **higher electrical insulation resistance**
- **better cold weather handling and durability**

Check the savings. Contact the Polyken distributor in your area.

Atlanta, Georgia: Steele & Associates, Inc.
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Cleveland, Ohio: The Harco Corp.
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Minneapolis, Minn.: Simcoe Equipment Co.
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Polyken Sales Division

In rotary drilling, pulling a 100-ton, two-mile string of drill pipe subjects the drilling line to the terrific stresses imposed by fast acceleration, shock loads, bending and overwinding on drums. Only wire rope with the highest degree of quality in hardness, strength and fatigue resistance can be used, for toolpushers know that . . .

A quality rope is a safe rope

Whether you use wire rope in the field or in a factory, *safety is just as important to you.* When you buy "bargain" rope you bargain with safety. It can cost you more than the pennies you save. Buy on the basis of *quality*—buy Wickwire Rope.

For extra strength—buy Wickwire's Double Gray IWRC extra improved plow steel wire rope

WICKWIRE ROPE A CF&I PRODUCT

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LOOK FOR THE YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
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5736

DU PONT
Better Things for Better Living
. . . through Chemistry

PETROLEUM ENGINEERING NEWS
LATEST PROPERTY AND APPLICATION DATA ON
TEFLON® Fluorocarbon resins

New heat- and acid-resistant seals of TEFLON® TFE-fluorocarbon resins check high pressures in oil-well tubular joints

Clutch facing of TEFLON 1 still in use after 5 years and 20 million cycles

The clutch shaft of the Patterson Time Compensator is driven from the walking beam of an oil well pump, giving clutch discs of TEFLON 1 a back-and-forth movement of about 60°. The machine must operate for at least two years without attention. The clutch must have uniform slip characteristics at all times. No lubrication is possible, because compensators are installed in hot and cold climates.

Oldest unit has been in use for five years. Its clutch has made over 20 million strokes, is still on the job. Measurements after two years' operation (and over seven million strokes) reveal wear of only .002" on clutch facing of TEFLON 1. The valves, with poppet heads also of TEFLON 1, have sealed 100% tight over the five-year period without a failure.

CLUTCH FACING (left) and relief valve poppet head are made of a TEFLON 1. Used in a time compensator mechanism, which regulates the pumping of oil, the parts are exceptionally durable, resist high and low temperatures and require no lubrication. (Compensator by Patterson Products; parts of TEFLON TFE-fluorocarbon resin by Graef Engineering Co. — both of Paramount, California.)

RING SEALS made of TEFLON TFE resins prevent leakage at pipe joints in wells developing high pressures as well as mild low pressure. Seals are extremely resistant to acids and heat. Front — GT-API sealed coupling. Background — mating HGT "Super-Slim" integral sealed tubing joint. Cutaway sections reveal position of seals. (Manufactured by Hardy-Griffin Engineering Corporation, a division of Atlas Pipe Inc., Houston, Texas.)

Even the ultra-high pressures in Gulf Coast oil and gas wells are tamed by seals of TEFLON resins. The seals pass hydrostatic tests to 17,500 psi without trouble. Nor is there leakage in heat-shock and gas-pressurization tests. The effects of alternate well flow and shut-in are greatly accelerated during the testing.

TEFLON TFE resins are rated for continuous duty up to 500°F. They are inert to virtually all chemicals encountered in oil extraction and refining and in petrochemical processing. Since they possess a "waxy" surface that decreases friction and prevents sticking, and have excellent recovery after compression, they are prized for making seals, gaskets, bearings, packings.

We'd like to show you how others have solved design and maintenance problems with TEFLON resins.

Write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 28-2-17, Du Pont Building, Wilmington 98, Delaware. In Canada: Du Pont Company of Canada (1956) Ltd., P. O. Box 660, Montreal, Quebec.

TEFLON®
is a registered trademark . . .

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein. This registered trademark should not be used as an adjective to describe any product, nor should it be used in whole, or in part, as a trademark for a product of another concern.

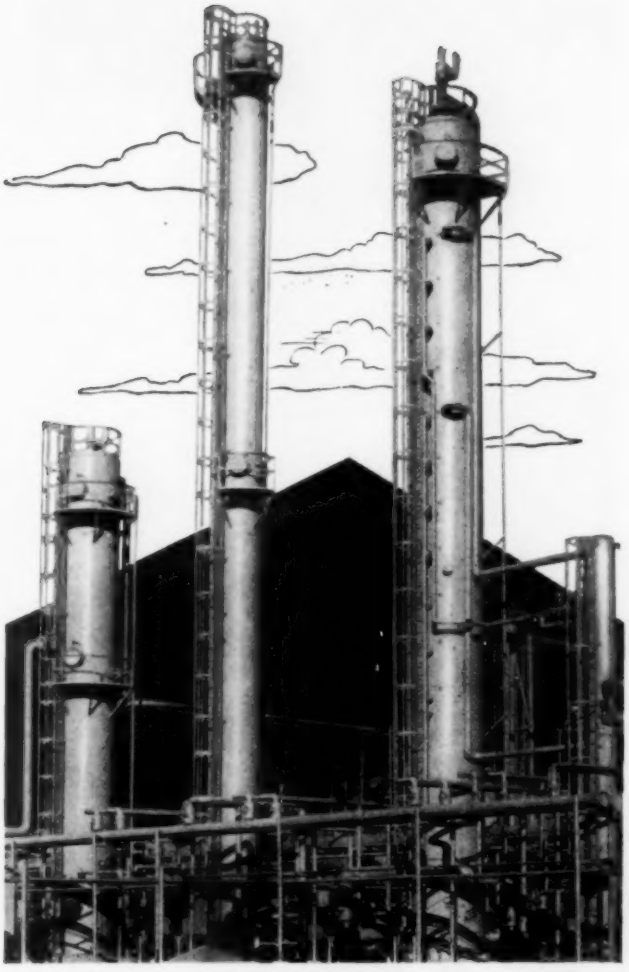
"We feel a responsibility to participate in the development of friendly foreign nations. Our participation is a practical and efficient supplement to our government's foreign aid program; we help to create understanding and respect for American ways and customs in foreign lands. And we believe that expanding international trade is of vital interest to our country's welfare and to world peace."

Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

Esso

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

fingers in the sky point to Dallas Quality



In these towers are reflected the highest skills of pressure vessel craftsmanship . . . to serve you better and provide trouble-free operation. Whether you require custom fabrication of fractionating towers, scrubbers and other vessels or field erection of our equipment . . . you can count on Dallas dependability and quality. We specialize in the fabrication of fractionating trays and caps in accordance with your design and also offer trays and caps as designed by Dallas Tank Engineers. We fabricate tube and shell equipment of all types covering all ranges of temperatures and pressures. Make Dallas Tank your headquarters for prompt, efficient fabrication service, domestic and foreign . . . call, write or wire today for quotations on Dallas quality fabrications.

TWENTY-FIFTH ANNIVERSARY
1933 1958
DALLAS TANK COMPANY
INC.

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Plants at Dallas, Texas and Vicksburg, Mississippi

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KEY Fittings have many distinct advantages, including simple design for easier maintenance and repair, fewer parts for less inventory and cost, rugged construction of any desired alloy for long life and safety, ample corrosion allowance, streamlined crossover port for minimum pressure drop and turbulence.

KEY® 5000 TYPE FITTINGS

Serve Socony Mobil Paulsboro Refinery

The heater in this modern refinery is equipped with new patented **KEY** 5000 type return bend fittings. Leading refineries everywhere use these fittings because they offer dependable and lasting service with real economy.

Our Bulletin No. KR-1057 contains complete details about the full line of **KEY** 5000 type fittings. Write now for your free copy.

Address Dept. A-217 for your copy of Bulletin KR 1057 by return mail.

W-K-M

DIVISION OF acf INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS
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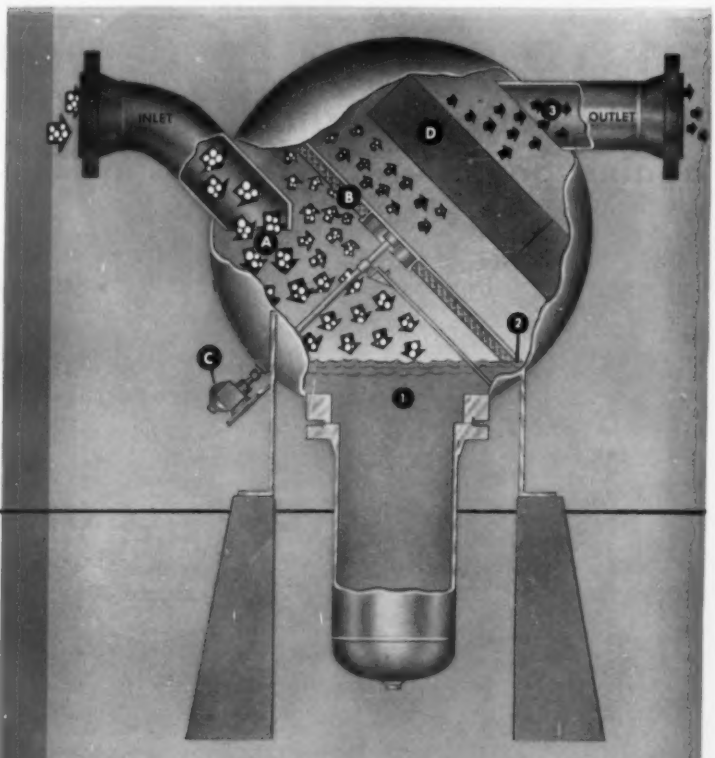
MORE EFFICIENT RESULTS!

PEERLESS SCRUBOSPHERE*

*Spherical scrubber for dust and liquid removal from gas flow

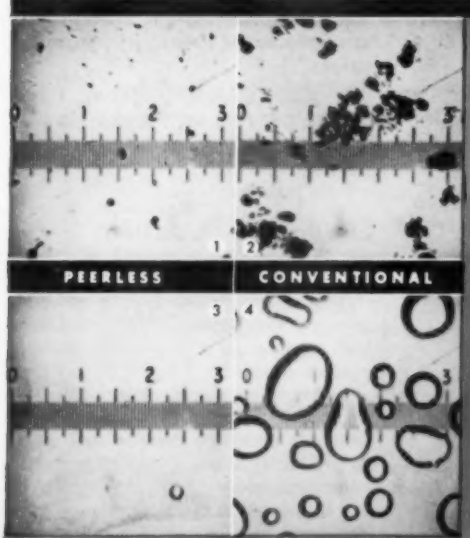


(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving through liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3



These photographs were made of microscope slides introduced downstream of the Scrubosphere and a conventional vertical oil bath cleaner under the same operating conditions. Plates 1 and 2 show the comparative amounts of iron oxide not removed with the amounts introduced being identical. Plates 3 and 4 indicate comparative oil loss with vapor rate through the vessels being the same.

LOOK AT THIS TEST The test at the left indicates the superiority of Peerless Scrubosphere over conventional oil bath dust scrubbers. The SCRUBOSPHERE operates with no loss of efficiency at low flows, minimum liquid loss, and very low pressure drop. Other outstanding features include easy vessel access with removable self-cleaning contactor, a sump for slugs of solid or liquid particles, and minimum cost.

For detailed information write for Bulletin No. 181

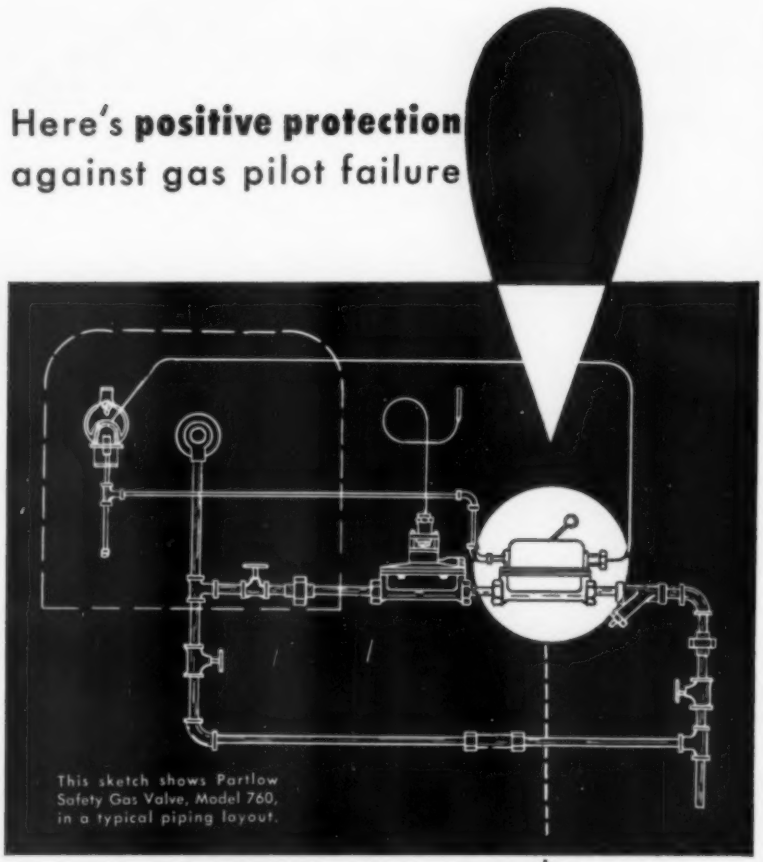
PEERLESS MANUFACTURING CO.

P.O. Box 13165 Dallas, Texas

Representatives in All Principal Cities

PEERLESS MFG. CO. DALLAS TEXAS

Here's **positive protection** against gas pilot failure



This sketch shows Partlow Safety Gas Valve, Model 760, in a typical piping layout.

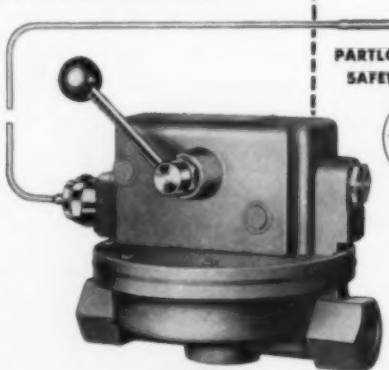
The Partlow Safety Gas Valve is ideally suited to oil field applications. *It's thermally operated . . . requires no electrical connections.*

This combustion safeguard gives positive protection to gas-fired appliances . . . prevents damage from gas pilot failure.

Rugged valve opens only after mercury actuated element becomes red hot from contact with pilot flame. If pilot goes out, element cools and releases a latch, causing valve to snap shut.

No conventional slip stem to corrode and stick. Strong perforated diaphragm guides valve disc to its seat.

PARTLOW MODEL 760 SAFETY GAS VALVE



WRITE TODAY FOR BULLETIN NO. 741

THE PARTLOW CORP.
Dept. G-258.
NEW HARTFORD, N. Y.

partlow

the pioneer in mercury thermal controls

Offices in All Principal Cities

They Say-

Management ought to speak

"Now is the time to go into action. We need to discuss issues important to employes, even if they are controversial. We should take a firm position and tell them where we stand on inflation, unemployment, labor legislation, taxes, government control of business, and similar issues that affect their business and their jobs. We should emphasize what we are for, rather than just what we are against.

"We need also to listen attentively to what our employes have to say. We have to give our employes an opportunity to express themselves to us, to ask questions, and to give them frank, honest answers. . .

"I make an urgent plea to each of you to join me in this effort to reach employes. In doing this it seems to me there are certain very simple rules for us to follow, such as: 1. stick to the truth; 2. gear what we want to say to the interests of the audience rather than talking in terms which please ourselves; 3. be affirmative and aggressive rather than defensive; 4. rely primarily on personal contact, to be supplemented by written communications."

L. F. McCollum, president, Continental Oil Co., in a speech to the Rocky Mountain Employers' Conference.

Oil doesn't fit pattern

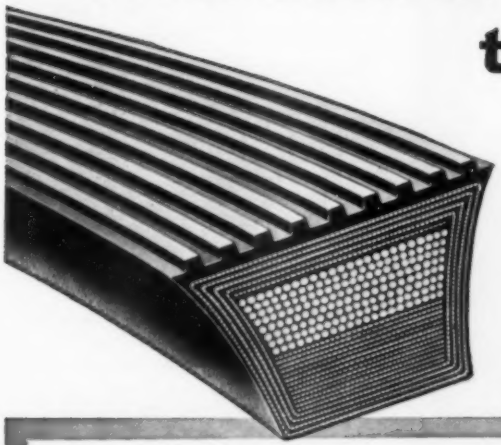
Dear Sir:

The Harris Bill should be enacted into law, not because it is a good bill, but because it is preferable to the present situation.

Federal legislation which undertakes to "shot gun" a given situation proceeds upon the premise that costs of producing a given product are uniform and stable. That, of course, is not the situation in relation to oil and gas.

Costs at wells vary in a substantial amount within a given field or area. And, when it is remembered that oil and gas are not found at uniform depths in all the fields producing, it then becomes a fallacy to undertake to establish uniform prices and prac-

Proved best for mud pump drives the world over...

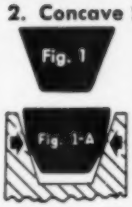


4 important engineering developments insure top performance from Rib-Top

1. Tougher, more resilient cords

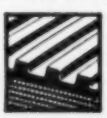
are able to absorb the severe pulsation of mud pumps; easily handle peak loads.

2. Concave Sidewalls (U.S. Pat. 1813698)



Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt... far longer belt life.

3. Stabilizing ribbed tops (U.S. Pat. No. 2548135)



— exclusive with Gates. Dampen vibration; protect top of belt; keep it running smoothly over idler-equipped mud pump drives without side whip.

4. Flex-Weave cover (U.S. Pat. No. 2519590)

provides greater flexibility with far less stress on fabric. Wears longer... lengthens belt life... lowers belt costs.

TPA-168

Used by more drillers on more mud pump drives than any other V-belt, Gates Rib-Top Vulco Rope is everywhere recognized as the outstanding performer in this tough service.

Rib-Top was developed *especially* for mud pump drives in the world's largest belt development center — at Gates — but costs no more than ordinary belts of comparable ratings. Available in Standard and Super at your oil field supply store.

Use Super Rib-Top for the tougher drives

With 40% greater horsepower capacity, Super Rib-Top easily handles drive overloads. Fewer belts and narrower sheaves solve space and weight problems.

Gates® The Mark of *Specialized* Research

The Gates Rubber Co., Denver, Colorado
World's Largest Maker of V-Belts

Gates Rib-Top Vulco Rope

DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES

EXTRA Personalized service in the field and in your office *plus* main plant follow-through are your assurance of rigid attention to detail and accuracy.

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tices, which is the goal of all regulatory agencies of government.

A. J. Pickett
St. Louis.

Gas export vital to Canada

"The discovery rate in Alberta and British Columbia has been so great in recent years that gas reserves have long passed the point when Canada will be able to use them.

"Growth of the reserves was stimulated by the original decision of the Alberta government to allow export from the province.

"When Westcoast and Trans-Canada pipelines were permitted to export gas, oil companies throughout the west stepped up the search for gas. The result has been the discovery of very large reserves, which now await continuation of development drilling.

"The only way, however, to insure development drilling is to provide markets for the gas—and this means export.

"Export, in turn, will stimulate new discoveries, provide for new industries, and distribute important economic benefits to all of Canada."

Frank M. McMahon, president, Westcoast Transmission Co., Ltd., in a speech at the company's annual meeting.

Extinct like the dodo

"The courts have now so altered the intent of the Natural Gas Act of 1938 that its retention serves no useful purpose. The utilities companies and, to a lesser degree, the consumers are protected; only the independent producer, who gloomingly contemplates the prospect of joining the dodo, takes the risk—and the rap. He is even worried about imports from Mexico and Canada, where FPC authority does not extend. Only a new law will save him from extinction."

GeoSurveys, in a statement to the press.

A reply for Denver's Mayor

"Companies and individuals who drill wells have only a one-in-nine chance of finding gas after spending hundreds of thousands of dollars in exploration and research prior to drilling.

"Furthermore, the price at the wellhead at the present time is insignificant (in the Rocky Mountain area) ranging from 7 cents per thousand cubic feet offered in northern Montana to only a few cents more in Col-

New ECONOMY with complete SAFETY

RECTOR UNIBOLT

Dual String Christmas Tree

The Rector Unibolt Tree is the only dual-string assembly to make use of Unibolt connections throughout, eliminating the weakness of threaded connections and the inconvenience of an all-welded hook-up. It provides two separate verticals clamped together and can be assembled and disassembled the same as a flanged tree, only quicker and easier.

UNIBOLT CONNECTORS provide high-pressure metal-to-metal seals with virtually the same positive safety factor as flanged connections.

With the new Rector Unibolt Christmas Tree assembly you get the safety of METAL-TO-METAL high-pressure seals between each connection . . . without the expensive dual master valve required in flanged trees.

Ask your Rector representative or your favorite supply store about the many advantages of this new field proven dual-string assembly.

RECTOR WELL EQUIPMENT COMPANY INC

★ MAKING THE OIL INDUSTRY SAFER

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Houston Plant: 2215 Commerce St.

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From Miami . . .

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orado. This in itself discourages further expenditures in search of gas.

"The producer is taking all the risk and becoming the victim of unjustified adverse publicity and the whipping boy of opportunity-seeking politicians.

"The statement that gas rates will increase $5 to $10 if the (Harris-O'Hara) bill is passed is quite absurd. Any such rate increase would be due solely to the utility and transmission company and not to the producer who is entitled to a fair return on his risk investment.

". . . Gas rates will certainly increase (if the bill does not pass), not by $5 to $10 per month, but $20 to $40 per month per family."

Dan Kralis, manager of exploration and production, Clark Oil & Refining Co., in a statement criticizing Denver Mayor W. F. Nicholson's opposition to the Harris-O'Hara bill.

CALENDAR OF EVENTS

FEBRUARY

20-22 Pipe Line Contractors' Association of Canada, annual convention, Empress Hotel, Victoria, B. C.

24-28 American Society of Civil Engineers, annual convention, Sherman Hotel, Chicago.

26-28 American Petroleum Institute, Division of Production, southern district meeting, Shamrock-Hilton Hotel, Houston.

28 Natural Gasoline Association of America, Permian basin regional meeting, Lincoln Hotel, Odessa, Tex.

MARCH

3-4 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fourth annual joint meeting of Rocky Mountain petroleum sections, Cosmopolitan Hotel, Denver.

5-6 Gas Conditioning conference, sponsored by the University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla.

7 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.

7-8 American Association of Petroleum Geologists, Pacific Coast section, annual meeting, Ambassador Hotel, Los Angeles.

10-13 American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists, forty-third annual meeting, Biltmore Hotel, Los Angeles.

12-14 American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Texas, Fort Worth

17-21 International Atomic Exposition, Inc., 1958 Nuclear Congress, Chicago Amphitheatre, Chicago.

17-21 National Association of Corrosion Engineers, annual conference, civic auditorium, San Francisco.

20-21 New England Gas Association, annual meeting Hotel Statler, Boston.

20-21 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, regional conference on production and reservoir engineering, Mayo Hotel, Tulsa.

24-26 Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo.

24-26 Western Petroleum Refiners Association, annual meeting, Hilton Hotel, San Antonio, Tex.

26 Petroleum Equipment Suppliers Association, southwestern district meeting, Shamrock-Hilton Hotel, Houston.

27-29 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Southwest conference, St. Francis Hotel, San Francisco.

29 North Texas Oil and Gas Association, annual meeting, Kemp Hotel, Wichita Falls, Tex.

31-April 2 American Petroleum Institute, Division of Transportation, annual pipeline conference, Jung Hotel, New Orleans.

APRIL

1-3 University of Oklahoma, fifth annual conference on corrosion control, Extension Study Center, Norman, Okla.

2 Petroleum Equipment Suppliers Association, eastern district meeting, Duquesne Club, Pittsburgh.

9-11 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Biltmore Hotel, Oklahoma City.

13-18 American Chemical Society, national meeting, San Francisco.

15-17 University of Oklahoma, thirty-fourth annual gas measurement short course, North Campus, Norman, Okla.

16-18 Natural Gasoline Association of America, annual convention, Baker and Adolphus Hotels, Dallas.

16-18 National Petroleum Association, fifty-fifth semiannual meeting, Hotel Cleveland, Cleveland.

17 Petroleum Equipment Suppliers Association, Pacific district meeting, Beverly-Hilton Hotel, Los Angeles.

17-18 Texas Technological College, fifth annual West Texas oil lifting short course, Lubbock, Tex.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Louisiana-Arkansas, East Texas, and Mississippi petroleum sections, gas technology symposium, Shreveport, La.

17-18 Geophysical Society of Tulsa, Tulsa Geological Society, annual midwestern exploration meeting, Tulsa.

17-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest regional conference, Spokane, Wash.

20-23 American Institute of Chemical Engineers and Chemical Institute of Canada, chemical engineering division; Canada-U.S. chemical engineering conference, Montreal.

21-23 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Cosmopolitan Hotel, Denver.

23-25 Second International Williston Basin Symposium, sponsored by Saskatchewan Geological Society and North Dakota Geological Society, Regina.

27-30 American Association of Petroleum Geologists, Rocky Mountain section, Casper, Wyo.

28-29 University of Oklahoma, third annual conference on automatic control in the petroleum and chemical industries, Oklahoma Memorial Union Building, Norman, Okla.

2-way gain with PUMCUPS

Cross-section of conventional and 45° bevel type Pumcups.

Darcova Pumcups are available in various types and textures, in a complete range of sizes, to provide unequalled efficiency and long life in reciprocating pumps, air or hydraulic mechanisms.

★ prolonged high efficiency
★ less maintenance

TODAY hundreds of companies using hydraulic controls, air cylinders or reciprocating pumps are *standardizing* on Darcova Pumcups for piston packing, because they eliminate fluid slippage, costly down-time and maintenance.

Darcova Pumcups make the *most* of the cup packing principle. And, they are made in a complete range of sizes, types and texture-engineered compositions for various pressure-temperature-fluid conditions. Pumcups hold peak efficiency for the life of the cups and outlast other packing as much as 3 to 1.

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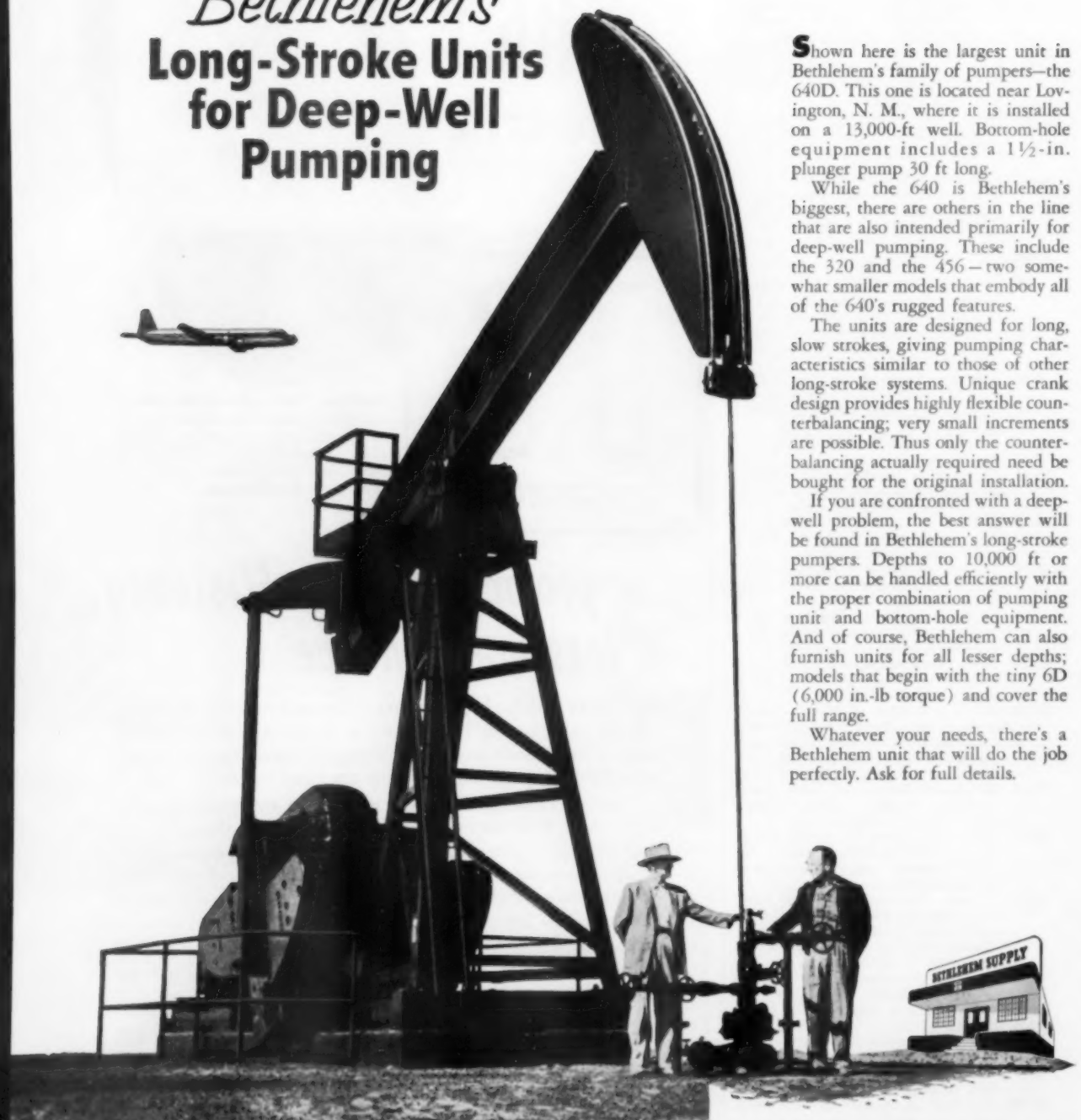
DARCOVA — THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

Bethlehem's
Long-Stroke Units for Deep-Well Pumping



Shown here is the largest unit in Bethlehem's family of pumpers—the 640D. This one is located near Lovington, N. M., where it is installed on a 13,000-ft well. Bottom-hole equipment includes a 1½-in. plunger pump 30 ft long.

While the 640 is Bethlehem's biggest, there are others in the line that are also intended primarily for deep-well pumping. These include the 320 and the 456—two somewhat smaller models that embody all of the 640's rugged features.

The units are designed for long, slow strokes, giving pumping characteristics similar to those of other long-stroke systems. Unique crank design provides highly flexible counterbalancing; very small increments are possible. Thus only the counterbalancing actually required need be bought for the original installation.

If you are confronted with a deep-well problem, the best answer will be found in Bethlehem's long-stroke pumpers. Depths to 10,000 ft or more can be handled efficiently with the proper combination of pumping unit and bottom-hole equipment. And of course, Bethlehem can also furnish units for all lesser depths; models that begin with the tiny 6D (6,000 in.-lb torque) and cover the full range.

Whatever your needs, there's a Bethlehem unit that will do the job perfectly. Ask for full details.

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25 Broadway, New York, N. Y.

28-29 Independent Petroleum Association of America, mid-year meeting, Sherman Hotel, Chicago.

28-30 Southern Gas Association, annual convention, Dallas.

MAY

1 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, annual joint meeting, Adolphus Hotel, Dallas.

5-6 Society of Petroleum Engineers of A.I.M.E., North Texas section, secondary-recovery symposium, Wichita Falls, Tex.

5-7 Purdue University, thirteenth annual industrial waste conference, Purdue Memorial Union Building, Lafayette, Ind.

5-9 American Gas Association, distribution, production, and transmission conference, Roosevelt and Commodore Hotels, New York.

7-9 American Petroleum Institute, Division of Production, eastern district meeting, Deshler-Hilton Hotel, Columbus, Ohio.

8-9 Texas Petroleum Research Committee, eleventh oil recovery conference, symposium on "A Century of Texas Oil, 1875-1975," University of Texas, Austin.

11-14 Texas Independent Producers and Royalty Owners Association, annual membership meeting, San Antonio, Tex.

12-14 Chemical Institute of Canada, National Research Council, eighth Canadian high polymer forum, Macdonald College, St. Anne de Bellevue, Quebec.

12-14 Instrument Society of America, symposium of analysis instrumentation division, Shamrock Hilton Hotel, Houston.

12-16 American Petroleum Institute, Division of Refining, midyear meeting, Statler Hotel, Los Angeles.

20-22 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

21-23 Rocky Mountain Oil and Gas Association, thirteenth annual convention, Cosmopolitan Hotel, Denver.

21-23 American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.

22-23 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

26-28 Chemical Institute of Canada, annual conference and exhibition, Royal York Hotel, Toronto.

JUNE

2-4 Petroleum Electric Power Association, annual meeting Texas Hotel, Fort Worth.

8-11 American Petroleum Institute, Division of Transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va.

10-12 Appalachian Underground Corrosion Short Course, School of Mines, West Virginia University, Morgantown, W. Va.

19 Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.

23-25 Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.

22-28 American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, Boston.

28-July 2 Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

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FOUR distinct divisions in one steel company, inter-related, specialists in their own field of endeavor and singly managed.
Some clients take advantage of all four, others one or more.
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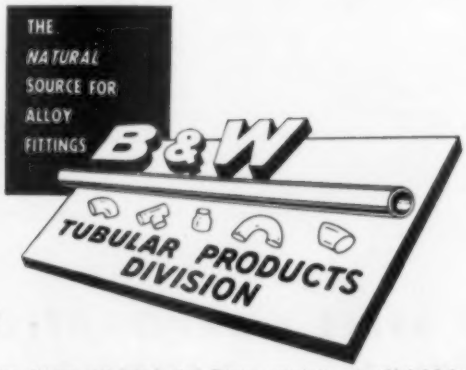

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

A Matter of Days

FAR BE IT from us to pick on an outfit when it's down. The National Petroleum Council is fighting for its life. The Government is trying to reorganize it under a set of arbitrary rules which, its members say, would destroy its usefulness and probably put it out of business.

Oil-industry leaders serving on NPC are pointing out that one of the council's big services is the publication of statistics and surveys which couldn't be obtained from any other source. This is quite true, and we wouldn't want to see NPC's scope curtailed in any way.

But we can't help bragging that the survey NPC issued last month was badly scooped by the Big Yellow Book. It's a survey of U. S. refining capacity as of March 31, 1957. It's an excellent survey, but we don't think it's a durn bit better than the one printed in the March 25, 1957, issue of the Journal—some 10 months earlier.

Our survey gives almost exactly the same information, and in the same detail, as the NPC report.

There's only one difference: Our survey is in stream-day capacities. This is how much a given unit can run going full blast for a single period of 24 hours. The NPC report is in calendar-day capacities. This is something less than our figures because an arbitrary allowance is made for shutdowns, accidents, market weakness, and the many other things that almost always prevent a refinery from operating at its theoretical maximum capacity 365 days a year.

We like our stream-day figure better, because it permits any user to make his own estimate of how much below theoretical maximum any particular refinery is apt to operate in a given period.

And when you make allowance for the difference between stream-day and calendar-day bases, you'll find that the figures in the two surveys check out very, very closely.

We're glad that NPC made its survey, because it proves that we have been accurate and complete all along—as well as being a lot speedier. You can rely fully on either one you use, provided you keep in mind the difference between stream-day capacity and calendar-day capacity.

We've been making our annual survey of refinery capacity for a good many years now. The next one will be in our March 24 issue—giving the details as of January 1, 1958.

No Smoking

IF YOU'RE an artist—or a Chamber of Commerce secretary—you like to see clouds of smoke billowing from factory chimneys. It indicates life, action, and industrial activity.

But if you're a resident of the vicinity you shake a mental fist at that smoke and think of soot, fumes, asthma, and even the deaths that have been attributed to factory fumes in some places.

Everybody knows about the smog problem in Los Angeles. But whether it's called smoke, smog, haze, or smaze it gets into the eyes of customers, stockholders, legislators, judges, editors, and a host of other people whose good will is essential.

Refiners are aware of that, and they are taking steps to prevent their stacks and flares from smoking—not only in Los Angeles where the law requires it, but in many other places that have no smog problem as yet.

Even though the fumes may be entirely harmless, refiners are trying to make them unseen and unsmelled. This is mainly a matter of good neighborliness and public relations, and to forestall restrictive legislation which might be demanded by an angry and uninformed public.

It costs a lot of money to break a refinery of the smoking habit, but in many cases refiners are finding that some of this expense is coming back to them through the recovery of products formerly wasted.

How refiners are doing this, what it is costing them, and what they are getting in return is told in a special 16-page section starting on page 87 of this issue.

It's a staff job, a Journal exclusive, and it tells more about air pollution and its control than you ever knew before. Even if you're not a refiner you'll find a lot of interesting dope in it.

—*Henry D. Ralph.*

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has been scraped clean and smooth with a

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Leaves the important "working surface" of the casing permanently safe for running swabs and testers, and for setting bridge plugs, packers or cement retainers.
★ Can either be rotated or "spudded" to remove hardened rotary mud, the thin sheath of cement left by the bit, and burrs from gun-shot holes. Usually run above the bit to clean the casing while drilling out cement.
★ Available anywhere, anytime; just specify Baker ROTO-VERT Casing Scraper, Product No. 620-C.

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How to get the Harris bill passed

ON the next two pages of this issue is a letter the Journal is sending to every member of Congress in support of the Harris gas bill.

For many years the Journal fought along with producers for legislation primarily in the interest of producers. We all failed to convince the public that what is good for producers is good for the nation.

Now we say that, for the first time, here is a gas bill primarily in the public interest. We believe that this is the only basis on which legislation can be—or should be—enacted.

PREVIOUS FAILURES to amend the law regulating gas production were due, we believe, to disregard of the attitudes and reactions of the general public.

Producers set up the cry that "we wuz robbed." They bored the public by rehashing the injustice and illogic of the Supreme Court's reasoning in the Phillips decision.

They bemused the public by recounting the hardships imposed on producers, thus arousing more skepticism than sympathy.

They confused the public with technical treatises and statistics on the geological occurrence of gas, reserve ratios, dry-hole percentages, and cost factors.

Such arguments are effective with the relatively few who understand them. But the general public—the gas consumers and their political and journalistic spokesmen—saw previous bills simply as a special favor for producers who didn't want their prices regulated.

And, to a large extent, that's what they were. Most of the advocacy of prior bills was pitched on the hardships of producers—a subject about which the general public couldn't care less.

This new Harris bill is different. It is designed to serve the public interest better than the special interests of any division of the gas industry. Perhaps that is why many distributors still oppose it and some producers aren't enthusiastic over it.

If the industry believes, as the Journal does, that this bill is in the public interest, then the industry should promote it on that basis and on that basis alone.

THE WAY TO DO THIS is to convince congressmen, and others interested, that most of the old arguments both for and against previous gas bills do not apply to this one.

Last week's disclosure of political bungling need not cloud the issue permanently. It can be overcome if the industry will promptly and earnestly stress the public-interest reasons for support of the bill.

The only way out of regulatory chaos is to demonstrate that here, at last, is a bill for the long-range benefit of the consuming public.

An Open Letter to

Mr. Congressman:

You will soon vote on H.R.8525, the Harris bill to regulate producers' prices of natural gas.

This bill is very different from its predecessors. It embodies a new principle and a new approach in this long-drawn controversy. So, in making up your mind, forget most arguments made for and against previous gas bills. Give only secondary consideration to the special interests of gas producers and distributors. Judge H.R.-8525 on its merits in the public interest.

The problem here is how to regulate a business. In any regulation of any business there are two objectives:

1.—Protect consumers against excessive prices and inadequate service and supply;

2.—Keep the business healthy so it can attract capital to maintain and expand its service.

H.R.8525 meets these dual objectives far better than any prior bill. It meets them in a practical, realistic, common-sense way. For the first time, Congress has before it a gas bill primarily in the public interest.

Gas Supplies Will Dry Up Without New Legislation

Federal regulation has been in effect nearly 4 years, but gas is still being produced and the percentage moving in interstate commerce has increased slightly.

Does this destroy the contention that insufficient supplies will be available for interstate markets? No—not in the long run.

Gas already committed to interstate sale will continue to move during the life of existing contracts. And many new gas wells are so located that an interstate pipeline is the only available market.

BUT—about half of all gas is used within the state of production, at prices unregulated by federal law. These local markets are growing rapidly as industry is attracted to the Southwest. Thus many producers have a choice of markets. If they don't like the interstate price set by FPC, or the red tape and uncertainties of regulation, they will sell locally.

Consumption of natural gas is increasing rapidly. Forecasts of this nation's growth in population and energy requirements foresee huge future demands for gas. Already some communities don't have enough to serve all potential customers.

Every producing well is gradually depleting its reserves (average well life: 20-25 years). New gas needed to replace this and to supply expanding markets won't produce itself. Somebody must invest money to discover new supplies.

It is not true that gas "costs nothing" because it is an unwanted byproduct of oil. Nobody will hunt for it deliberately without hope of a decent profit. It's a risky venture, and if the interstate price is not attractive the regulated market won't get much gas in the future.

This is not a "sellers' strike." It's a matter of simple economics. Gas supplies won't dry up overnight. But new supplies for interstate markets just won't keep pace with the growth in demand.

Producers try to avoid interstate sales now because of long delay in getting FPC approval of a new contract. Once a satisfactory contract is made there is no assurance that FPC won't order a price reduction some time in the future. They can't get financing under these uncertainties.

Already these results are beginning to show up:

... It's an open secret in the industry that producers who can afford to do so are holding huge gas reserves shut in, waiting for good local markets or removal of uncertainties in interstate sales.

... Interstate transmission lines are having trouble contracting enough new gas to maintain their present sales commitments, to say nothing of expanding to serve new customers.

... Most interstate pipelines and many local gas utilities are becoming alarmed that gas will soon be in short supply.

Gas Prices Will Go Up Some With or Without This Bill

Old estimates that consumers' gas bills will rise hundreds of millions of dollars if the bill is passed don't apply to H.R.8525. The bill deals with two classes of gas prices:

1.—Prices for gas now moving interstate under existing long-term contracts;

2.—Prices to be paid in the future for gas not yet contracted or even discovered.

As to existing contracts, this bill prohibits "windfall" increases—the rapid and unpredictable jumps which alarmed consumers before 1954. It permits only those increases definitely specified as to date and amount. As to future contracts, the bill allows buyer and seller to negotiate a deal—with these restrictions:

... There can be none of the outlawed type of price escalations;

... FPC must approve or reject the price scale after hearing all interested parties.

This means that the national average of field prices will rise gradually and moderately over the years as (1) permissible types of step-ups in existing contracts take effect, and (2) as and if pipelines offer more for new supplies. Against this it should be realized that:

... The field price of gas is only about 10 per cent of the consumer's price at the burner tip;

... Price increases will be predictable, so distributors and consumers will be able to plan for them;

... Competition from coal and oil will keep gas prices from going too high too fast.

... Prices of everything are going up, including cost of discovering and producing gas.

Gas prices jumped sharply in the early 1950's because suddenly all the cheap surplus gas was bought up. That can't happen again because new field prices are now

Congress on the Harris Bill

on a plateau that represents roughly what both sellers and buyers think it is worth.

BUT—present FPC regulation has not and will not prevent some increases in field prices. Reasons:

... **In not one single case** to date has FPC been able to reduce a producer's price by proving it to be excessive.

... **Many scheduled price increases** have gone into effect with FPC approval.

... **All recent contracts** have initial prices higher than older contracts. (FPC has no control over initial prices in new contracts, though it may reduce them later after investigation.)

... **Under the existing cost formula** some producers will prove that they are entitled to higher, rather than lower, prices.

What's Wrong With the Present Method of Regulation

FPC is trying to fit a square peg into a round hole. The Natural Gas Act of 1938 (made applicable to producers by the Phillips decision of June 7, 1954) was designed to regulate interstate pipelines. Four years of experience has shown it is ill adapted to regulating field prices of gas.

FPC has not yet been able to define the standards it will use to determine if a producer's price is "just and reasonable." Every separate factor of such standards is still a matter of controversy. FPC is nowhere near final decision in even the very first of scores of pending cases where it is trying to determine a producer's cost. And every such decision is certain to be carried to the courts for years of litigation.

FPC admits the present law gives it an impossible administrative task, saddling taxpayers, ratepayers, and producers with high litigation costs. (See House Report 837, pages 27-31). Gas production is so different from the usual public utility that there are a score of practical reasons why its regulation should be different from the utility cost-of-service formula.

Under the present cost formula a dissatisfied producer can circumvent the intent of the law by selling his entire operation to a pipeline. The pipeline can then charge the purchase price as his cost and raise prices accordingly.

Recently several big utilities have purchased new gas supplies directly from producers. This eliminates the pipeline as middleman, gives them direct control over their prices, and gets out from under much FPC regulation. This demonstrates a growing conviction that the present method of regulation is unsatisfactory.

How H.R.8525 Is Different From Previous Gas Bills

The Harris-Fulbright bill—vetoed by President Eisenhower in 1956—was, frankly, a "producers' bill." So was the Kerr bill, vetoed by President Truman in 1950. This new bill, H.R.8525, is not. Most gas producers have quit trying to get complete exemption from federal regulation.

This bill is not just a compromise "to get something through Congress." It is a new approach, and it incorporates new principles of regulation. It embodies the results of long study by representatives of all branches of the gas industry earnestly seeking a mutually satisfactory solution of the deadlock. It conforms to recommendations of the Federal Power Commission.

There are two possible ways of determining the price of anything: Cost of production, or value to both seller and buyer. H.R.8525 abandons the attempt to base gas prices on cost. Instead it turns to value.

The value approach involves factors of judgment rather than a mathematical formula. H.R.8525 utilizes the combined judgment of sellers, buyers, and the FPC. The standards by which FPC is to exercise its judgment are spelled out in Section 16 of the bill.

H.R.8525 does not exempt field prices from federal regulation. Instead it subjects them to a new form of regulation. This new form was not designed to suit producers, pipelines, or distributors. It was designed to suit the public interest.

This new Harris bill is now acceptable to the FPC, to the majority of producers, to most interstate pipelines, to many distributors, and to many people who opposed predecessor bills.

Why Enactment Now Is In the Public Interest

Passage of H.R.8525 will end a long controversy that won't settle itself.

It will eliminate hundreds of complicated law suits.

All divisions of the gas industry can live under it.

Consumers, distributors, and producers can plan intelligently, without the frustrating uncertainties surrounding present price schedules. Consumers are protected against run-away prices by specific safeguards written into the bill (see Committee Report, pages 14-19).

It will make new supplies available for interstate markets by offering producers an incentive to hunt for gas directly. If it does result in a gradual increase in average field prices it will be because competitive factors of supply and demand work out that way and because buyers offer higher prices for additional supplies.

Before the Phillips decision, field prices were entirely unregulated. Since then they have been regulated under a public-utility formula. Neither condition proved entirely satisfactory to all concerned.

This new Harris bill, H.R.8525, offers a new type of regulation, not written for any special interest, but for the public interest.

Respectfully,
The editors of The Oil and Gas Journal

THE OIL AND GAS JOURNAL

February 17, 1958

DELTA'S E. Constantin, Jr. (far right) argues for quota before Imports Chief M. V. Carson (far left).

New Import Controls May Be on Way

• Government admits problem is getting more serious; cabinet committee will meet to decide future course. Eastern States is threatening to ignore the program, and other companies are demanding quotas as new importers.

THE ADMINISTRATION is moving toward a quick review of the voluntary oil import program.

Commerce Sec. Sinclair Weeks, chairman of the cabinet committee on imports, called his committee into session last week and said another meeting will be held within the next 10 days or 2 weeks. Definite steps to strengthen the import-control system may follow.

Weeks blamed three developments for the need for committee consultation: High inventories, smaller domestic demand than expected, and new applications for import quotas.

Weeks' concern over the situation was shown by his issuance of a statement at the weekend, when normally the government agencies are closed.

The committee, he said, "realizes that the problem has become increasingly serious."

Weeks indicates that the top-level group looks with disfavor on any marked increase in imports as newcomers seek to enter the field.

"The cabinet committee continues to be well aware of the importance to the national defense of maintaining a strong and dynamic oil industry in this country," he said.

Other action . . . There were these other developments in the import field during the week:

. . . The House Ways and Means Committee prepared to open hearings on extension of the Reciprocal Trade Act, with the domestic industry firm in its demands for mandatory controls.

. . . Eastern States Petroleum & Chemical Corp. threatened to pull out of the import program if the Defense Department continues to buy jet fuel in the Caribbean area.

. . . Hearings on newcomer requests for quotas were opened by Capt. M. V. Carson, Jr., program administrator.

Weeks did not say in his statement what the cabinet committee might do to correct the situation. But it was viewed as a warning that formal import quotas would at least be considered, if not adopted.

It is generally accepted that the voluntary program has registered success largely because of the downturn in business generally. The downturn also has led to larger inventories and threats of widespread cuts in crude prices (OGJ, Feb. 10, p. 65).

And with newcomers asking for more than 200,000 bbl. a day in imports, conditions are reaching an acute stage.

It is this situation on which domestic producers will build their case for mandatory controls when the ways and means committee discusses imports.

Caribbean issue . . . Eastern States' attack on the program came in the form of a wire to Carson. R. B. Kahle, president of the company, charged that it "is fundamentally wrong for the Government to do something which it asks the citizens not to do" by buying foreign jet fuel.

The General Accounting office held that the Military Petroleum Supply Agency cannot properly consider the import duty in evaluating bids by Caribbean refineries.

This ruling "causes us to very seriously doubt the validity, priority, or integrity of any effort made by the cabinet committee to restrict crude imports, voluntary or otherwise," Kahle said.

The fact that the cabinet committee limited its program to crude as distinguished from products is "begging the question," he added, because there is no justification to restrict crude and at the same time permit unlimited imports of products.

"If government continues its purchases of substantial quantities of petroleum products from Caribbean sources, we will no longer feel obligated in any manner to comply with the voluntary oil import program, and we will obtain our oil supplies as does our government from those sources that in our opinion produce the lowest possible cost to us," Kahle said.

That assertion, Carson retorted, "would not seem to mark any departure from the company's present policy."

Eastern States has not complied with the program at any time, Carson said. Its own figures show it exceeded its quota by 35 per cent during the first 6 months of the program.

Carson said Kahle testified last September, when given a hearing on his quota, that contractual commitments prevented full compliance with the program. If his contracts could be adjusted, Eastern States would be more than willing to comply fully, Kahle testified.

Carson said, however, Eastern States was protected in its import contract with American Independent Oil Co. The decision on Eastern States' application for a quota carried the notation that "there are provisions (in the American Independent contract) designed to relieve the petitioner of liability in event of governmental action."

The Delta case . . . Delta Refining Co., which last month brought in an unauthorized cargo of Venezuelan crude, and its sister Southland Oil Co., were the star attractions as hearings on newcomer quotas opened.

The two companies are under the single ownership of E. Constantin, Jr., who holds 90 per cent of Delta and 98 per cent of Southland.

Constantin asked for a 20,000-bbl.-daily quota for each company. He admitted, however, that Delta will not be able to use that amount for perhaps 8 months or 1 year and Southland for at least 18 months.

Delta has a refinery at Memphis which is now "balanced" for a 15,000-bbl. output daily, but "bugs" are holding it down to 10,000-12,000 bbl., Constantin said.

The plant, however, will be raised to a capacity of 24,000-25,000 bbl. daily within the next 6 to 12 months and then will need its full quota of foreign crude.

"Economic conditions which developed in the industry as a whole made it absolutely necessary for our survival to acquire additional crudes for refining," Constantin told Carson. The only domestic crude the company could get was in small amounts in spot markets.

May build refinery . . . Southland plans to build a 20,000-bbl. refinery on 600 acres of land secured near Tampa, Fla., Constantin said. But actual construction has been held up for lack of foreign crudes.

Constantin explained that a quota is sought for use in the event conditions change and the company decides to go ahead with the plant. It would take 8 months to build a skimming plant and 18 months for a complete refinery.

The refinery will be built only if foreign oil can be brought in. Constantin said it would be "uneconomic to compete using domestic crude." The plant could operate successfully only on a 100 per cent supply of foreign oil.

Carson added: "Is it good business to invest millions of dollars in a refinery that can only be run at a profit by using foreign crude?"

Constantin replied: "If everybody was using domestic crude, we would all be competitive." He added that his plant could not use domestic oil and compete with refiners who have access to foreign supplies.

Carson questioned the advisability of tying a refinery to a single source of foreign crude. He pointed out that the foreign supply might be interrupted. That occurred in 1956, when the Suez Canal closed down and shut off Middle East oil.

"I'm not going to deal with that bunch over in the Middle East," Constantin replied. "If I can't buy crude in Venezuela, I don't want it."

The Falcon case . . . A protest against being treated as a newcomer was lodged by Cecil V. Hagen, president of Falcon Petroleum Corp., whose request for a 5,000-bbl. quota also was heard.

Falcon has a history as an importer, Hagen said. It imported crude from 1953 to 1957. Last year its entire supply, produced by Talon Petroleum, C.A., in Venezuela, went to France when the Suez closing increased the demand for Western Hemisphere oil.

The French contract has expired, and the company now has no outlet for its output of around 2,000 bbl. daily.

Price Daniel Asks Import Study

GOV. PRICE DANIEL of Texas last week named an 11-member commission to see just how bad "excessive oil imports" are hurting Texas and to recommend counter measures.

Daniel said he will ask the new oil-imports commission to make a complete study and report on the effects of excessive imports of crude and crude products on Texas' employment, exploration, production, state and local revenues, and general economy.

There is little doubt that the new Texas import-study commission will find imports damaging the Texas economy. But observers find it hard to predict any effective action the state might take as a result.

Texans charged with making the study and the recommendation are:

French Robertson, Abilene, attorney and independent oil man; Dr. John R. Stockton, director of the University of Texas Bureau of Business Research; Earle B. Mayfield, Jr., Dallas tax attorney, counsel to the commission; Guy Warren of Corpus Christi, former president of the Texas Independent Producers and Royalty Owners Association.

John Lee, state representative from Kermit; M. P. Connally, Baytown refinery worker; Charles K. De Vall, Kilgore publisher and president of the Texas Good Roads Association; Berl Godfrey, Fort Worth banker and president of the West Texas Chamber of Commerce.

Lawrence Hagy, Amarillo, former president of the Panhandle Producers and Royalty Owners Association; Ted H. Riggs, Houston oil and gas attorney; and Bruce Street of Graham, past president of the West Central Texas Oil and Gas Association and a director of the IPAA.

Gas Bill Chances Hurt

. . . by publicity given oil man's letter praising Republican leader. Speaker Rayburn says action on bill to be delayed.

CHANCES of house passage of the Harris gas bill faded to a shadow last week.

Even its strongest supporters in Congress conceded the measure has little chance after publication of an invitation sent out by H. J. (Jack) Porter, Houston independent producer and Texas Republican national committeeman, to a $100-a-plate "appreciation" dinner tendered Rep. Joseph W. Martin of Massachusetts. The dinner was held Monday in Houston.

Porter's letter recited that Martin "has always been a friend of Texas, especially of the oil and gas producing industries."

"It will be up to Joe Martin to muster at least 65 per cent of the Republican votes in order to pass the gas bill this year," Porter said.

News story does it . . . The background of the dinner, which raised $100,000 for the GOP war chest, was disclosed by the influential Washington Post in a story which was picked up quickly by newspapers all over the country. The Post ran a front-page story on the dinner, another rehearsing the Case "bribe" scandal which led to veto of the first gas bill in 1956, and a scathing editorial.

Martin himself said he knew nothing about Porter's letter when he attended the dinner. He made no reference whatever to the gas bill in his address.

The House minority leader appeared irked by Porter's statement that he (Martin) "has to put Republican members from northern and eastern consuming areas on the spot politically because the bill is not popular due to the distortion of facts by newspaper columnists and others."

Reaction to the affair was quick and emphatic.

The Republican National Committee announced it would not accept the money raised through the dinner.

Martin said the Harris bill was probably dead. Asked about its prospects of passage, he said: "I wouldn't think after this incident it would be very likely." And, Martin added, it would be impossible for him to influence 65 per cent of the Republican members to back it.

House Speaker Sam Rayburn said action on the bill likely will be delayed "until the fire has cooled." But he would not predict its fate beyond admitting that it had been hurt, and the outlook was doubtful.

The White House and the Republican National Committee formally disowned the whole affair.

Rough history . . . Chances for passage of the bill had not been too good to begin with. Informed congressmen said the Porter incident would send members from the consuming states scurrying for cover.

The original Harris bill was passed by the House by a narrow margin. It received a larger majority in the Senate. But it was unexpectedly vetoed by President Eisenhower just 2 years ago this week, after disclosure of an offer of $2,500 to the campaign fund of Sen. Francis Case of South Dakota by a representative of an oil company.

The effort to relieve independent producers of onerous regulation stumbled again last year. House leaders wouldn't bring the bill up for vote because they feared they couldn't pass it. It later developed that the measure probably would have gone through with little difficulty.

This year found opponents of the bill lined up for a bitter fight. They had some support from coal-state congressmen, who said they wouldn't accept the measure unless amendments to ban below-cost industrial sales were written in.

New provisions to placate both the coal interests and the pipelines which oppose restriction are being worked out by Rep. Oren Harris of Arkansas. But now they may be just another slug to be fired against the bill by opponents.

New Way to Halt Gas Flaring

. . . will be tried by Humble if Texas Commission approves; Plymouth field gas to be "banked" in neighboring field.

IF YOU'RE flaring gas because there appears to be nothing else to do with it, maybe you can "bank" it.

That's what Humble Oil & Refining Co. plans to do with gas it is now flaring in Plymouth field in San Patricio County on the Texas Gulf Coast.

Some months ago the Texas Railroad Commission hinted rather broadly that Humble should stop flaring the gas from its Plymouth leases.

Humble looked over the possibilities. It finally decided to gather the gas, move it by pipeline to neighboring Taft field, and store it in the 3,700-ft. gas sand under its Mayo lease there.

The company asked the Railroad Commission for approval of the plan last week. Along with the Plymouth flare gas, Humble also will inject spent gas from Plymouth gas-lifting operations.

The 3,700-ft. gas sand in Taft field blankets a faulted anticline structure covering about 175 surface acres. The pay is about 24 ft. thick and has a water drive. Current pressure is 1,607 psi.—a drop of 81 psi. from the original figure.

The field has 35 wells and had produced about 6.122 billion cubic feet of gas to December 1, 1957.

Humble plans to convert its well No. 35 to injection service and inject about 860 M.c.f. daily into the sand through perforations from 3,746-64 ft. Surface injection pressure would run around 2,000 psi.

Humble figures the storage program should last about 2 years.

Safeguards needed . . . The company feels, however, that it needs some protection if it is to follow through on this plan.

Company engineers think the gas zone's gas-water contact, now at 3,722 ft., will move downdip as gas injection builds up. It is possible for the contact to move to such extent that the gas might be moved off Humble leases, Humble thinks. If this should occur, it says, another operator could complete a producing well and make off with Humble's stored gas.

To protect itself against this contingency, Humble suggested that the commission adopt the following rules:

. . . 467—1,320-ft. spacing.

. . . 320-acre proration units with 10 per cent tolerance and a maximum of 6,000-ft. between the farthermost points.

. . . Field allowable based on nominations.

. . . A gas-bank rule giving credit at a future date for gas stored.

. . . 100 per cent acreage allocation.

. . . Double the normal allowable for an operator who has stored gas in the zone.

Two Rangely Floods

begin. Pilot projects will supplement gas injection.

TWO PILOT water floods are under way in northwest Colorado's Rangely field, largest in the Rocky Mountain area.

The 481-well pool was unitized last October 1, with The California Co. as operator, in an effort to increase ultimate recovery from the Weber zone.

A water well and an injection well for the pilot flood on the east end of the 19,120-acre unit have been completed. Water is being injected at the rate of 560 bbl. per day.

On the north end, a source well and an injection well are in the process of being completed.

Gas injection was already being carried out in the field at the time of unitization with about 95,000,000 cu. ft. being sent back to the Weber sand. Injection capacity has been increased to about 13,000,000 cu. ft. per day, and a shift to crestal injection is under way.

If the pilot water floods are successful, the program will be expanded to a field-wide operation.

It is estimated that use of secondary recovery techniques will add 40,000,000 bbl. of oil to Rangely field's ultimate recovery.

Special Session

of California Legislature to study subsidence problem.

CALIFORNIA'S Gov. Goodwin J. Knight has agreed to call a special session of the state legislature to consider bills to help halt costly subsidence at Wilmington field.

Exact date of the special session will be set later. The 1958 legislature, currently recessed until March 3, is restricted to budgetary matters except when special calls are made.

Knight said the present state law is not adequate and that a congressional committee is looking to the state legislature to take steps in solving the problem. Subsidence has caused much damage to the naval shipyard in the area.

The Long Beach City Council recently approved proposed legislation calling for voluntary unitization and repressuring for the pool wherever possible. However, if the voluntary approach fails, the state oil and gas supervisor would be empowered to order compulsory unitization on either a fault-block or field-wide basis.

watching WASHINGTON

... with Bertram F. Linz

• Government looks to business upswing

THE LAG IN BUSINESS—no Washington official will publicly refer to it as a recession—is becoming more worrisome to the Government day by day.

Administration spokesmen are hopeful that spring plowing will halt the downtrend. They still predict an upturn in activity by midyear. But they are beginning to hedge their forecasts with the ominous addition of "or not later than September."

Unemployment is fast nearing the 4½-million mark. But that is only a piece of the story. Another piece is the increasing number of workers on part time.

Budget officials admit that estimates of revenue made only last December are now without meaning. But they do not plan another look at the prospects for 2 or 3 months, when they hope the picture will be clearer.

Talk of tax cuts to give business a shot in the arm is spreading. It has been suggested as high as the President's cabinet, some of whom believe reductions will be needed if conditions are not better by June. Eisenhower opposed tax cuts last month. This month he admitted they may be asked if business doesn't get better next summer.

• White House faces import showdown

NEW IDEAS ON IMPORT CONTROL will come soon from the White House in an all-out effort to prevent the scuttling of its foreign-trade program.

Hearings on extension of the Reciprocal Trade Act have opened. The one big issue is import control. And there are many signs that Congress is ready to write some new language into the law.

Mineral interests have lined up a lot of support for their demand for higher metal tariffs. Oil producers can muster a lot of backing for their call for quotas. Other industries also have big stakes in the issue.

Some sort of formal control appears inevitable. For oil, the problems raised by new importers and the threat of violation of the voluntary code brought out by the recent nonquota import by Delta Refining Co. must be solved. And the voluntary programs have no teeth.

The administration is opposed to anything that smacks of quotas. But it is less opposed to control by executive action than the control by law. There is more room for placating foreign resentment in the former. Whether the White House can come up with a satisfactory formula is the big question.

• Probers want to play G-man abroad

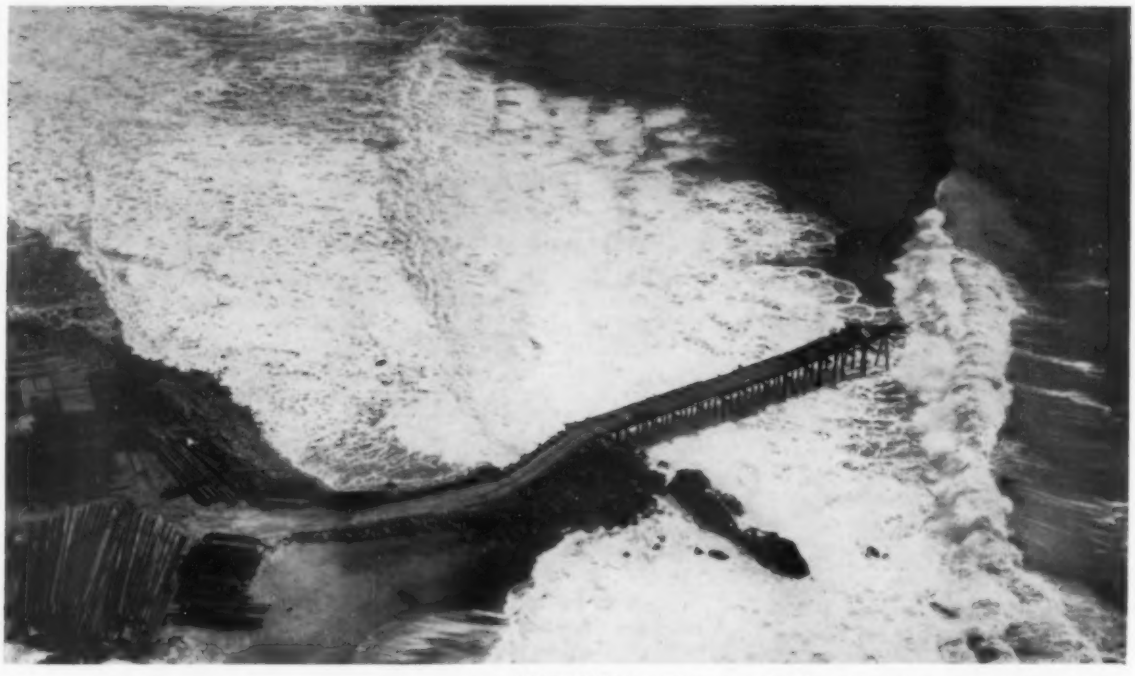
SOME MEMBERS of the Senate antitrust subcommittee have an idea, growing out of last year's probe of the European oil lift and Arabian American Oil Co.'s operations in the Middle East.

They think they ought to go abroad and "see conditions on the ground" to get a "better picture" of the problems they study.

A lot of committee members, especially in the House, get to take junkets each summer. A group from the House commerce committee even had a trip to the South Pole last year. These tours cost the taxpayer a little extra—but maybe they pay off in better legislation.

The antitrust subcommittee hasn't gone so far as to demand the right to play G-man abroad. This year it will have to content itself with a little $365,000 fund which Senator Knowland of California sought unsuccessfully to have reduced. That's $90,000 more than it got last year, but not enough for traveling money.

But Senator Dirksen of Illinois warned the Senate that one of these days the subcommittee is going to ask for $1 million to spread out.



HIGH WAVES rolling onto the West Coast are one reason why . . .

Drilling Off California Will Be Tough

Oil men face two other headaches not encountered in gulf drilling: Deeper Pacific waters and inadequate harbor facilities. On the asset side, however, is the famous California weather which provides fewer storms.

William T. Smith
West Coast District Editor

AFTER A 2-YEAR series of starts and stops, 1958 looks more and more like the year California offshore drilling finally may get going in a big way.

A new set of leasing laws is now available—put on the books last year (OGJ, Sept. 23, p. 76) after new tidelands leasing was shut down pending their completion.

The riddle of what royalty rates and other lease terms will be may be solved within a few months (OGJ, Jan. 20, p. 78).

When these preliminaries are cleared, the way then will be opened for new leasing, and particular attention again will be paid to the region from Point Conception to Newport Beach (see map).

When the time comes to move offshore in earnest, the newcomers to California tidelands work can take it from the few veterans who got started before the confusing ban that conditions will be tough.

Unlike work in Gulf of Mexico waters, California offshore locations encounter higher waves, greater water depths, fewer adequate harbor and onshore facilities. However, on the asset side is the California climate.

Waves . . . On an average, wave action is considerably more severe off the California coast than in the gulf.

Waves produced by westerly winds from storms originating in the Pacific from Alaska to Japan frequently cause waves with significant heights of 26 ft. for periods from 12 to 36 hours. Westerly-wind waves have been recorded in excess of 33 ft.

A recent check of U. S. Navy Hydrographic Office charts of a typical gulf area showed no waves with significant heights above 18 ft. and the few 18-ft. waves were of very short duration. A 3-year study showed gulf waves exceeded 10 ft. less than 1 per cent of the time. On the Pacific coast they exceed 10 ft. 2.5 per cent of the time.

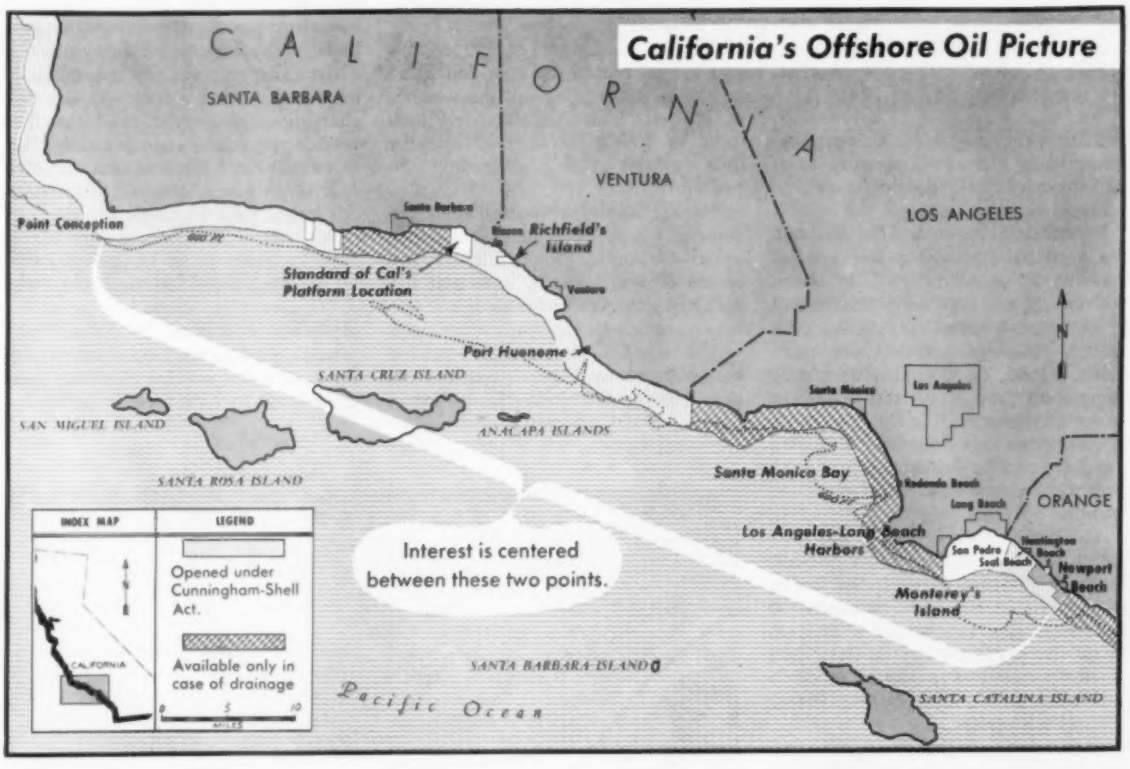
Currents off California are mild, rarely exceeding 1.5 knots.

In several places, a chain of offshore islands along Southern California shelters the coast. Santa Catalina and San Clemente islands offer quite a bit of protection to Santa Monica Bay and help to some extent in modifying wave action south of Santa Monica Bay to Newport Beach and Huntington Beach.

San Nicholas, San Miguel, and the smaller Santa Barbara Island offer limited help in cutting down wave action near the shoreline. Small, steep waves occur occasionally in several areas between these smaller islands and shore which hamper small boat operations, but are not serious enough to affect platforms or drilling barges.

In addition, the configuration of the coast from Point Conception to Santa Monica Bay, the area of greatest interest to offshore operators, offers natural protection from northwest weather produced waves. This part of the coast runs almost west to east, rather than north to south as is generally supposed.

The months from May through November offer the calmest conditions



offshore with wave heights only occasionally exceeding 5 ft.

Depths . . . It's in this category that prospective California offshore operators run into the biggest trouble.

From San Diego to Newport Beach, the beginning of the Los Angeles Basin oil country, the 600-ft. contour occurs mostly within 6 miles of shore. From Newport Beach to Palos Verdes just northwest of the Los Angeles Harbor, the 600-ft. contour is found mostly about 15 miles offshore. At Palos Verdes itself, it comes in as close as 2 miles from shore. The rest of the way up the coast, it occurs at distances varying from 2 miles offshore to 10 miles at Santa Barbara. At Point Conception, the 600-ft. contour is reached 4 miles from shore.

Actual ocean floor conditions are excellent all along the coast with anchoring expected to offer no problems.

In several areas, deep canyons are found, typical of which is one at Redondo Beach in Santa Monica Bay where the ocean floor drops from 300 to 1,500 ft. in less than a mile.

Harbor facilities . . . Here again, California operators run into trouble.

Considering the area of interest—Point Conception to Newport Beach—there is only one harbor capable of handling all phases of offshore operations. It is the Los Angeles-Long Beach harbor area.

There is a smaller harbor at Port Hueneme with good but limited facilities. It is under control of the Navy, and with the recent announcement that an ICBM testing station is being established at neighboring Point Mugu Missile Test Center, this port probably won't be available to oil companies.

Santa Barbara has a small yacht harbor which is adequate for personnel craft and small supporting vessels. But it is inadequate for any major ocean-logistic problem.

This leaves only Los Angeles-Long Beach harbors. Using these harbors, for instance, operators face a 140-mile jaunt to potential drill sites between Point Conception and Santa Barbara. From Los Angeles-Long Beach to Standard Oil Co. of California's offshore structure now under construction at Summerland is 108 miles. It is more than 100 miles to Richfield's artificial island being built at Rincon.

Weather . . . Californians have made no secret about their weather.

Southern California is particularly blessed with good weather. Hurricanes of the gulf variety are virtually unknown—the weather bureau records show only one in the last 65 years.

Rainfall on the California coast varies from an average of 37.58 in. a year at Eureka on the Oregon border to only 11 in. at San Pedro in the Los Angeles Basin. The rainy season extends from November through March. Summer thundershowers are rare.

Winds, like the rain, are fairly moderate. Prevailing winds vary from season to season but are mostly from the north, northwest, and west in an onshore direction. Velocities on an average range from early morning calms to 14-18 knots in midafternoon.

Westerly winds up to 50 knots are recorded occasionally with southwest winds reaching 45 knots.

Another wind force, this one from onshore, is the Santa Ana wind. This is a desert-born wind which whips through mountain canyons between the desert and the ocean. Santa Ana winds have been recorded in gusts to 78 knots, mostly in the fall and winter.

An average day off Southern California's coast shows winds picking up about noon and reaching maximum velocity of 14 to 27 knots, depending on topographical protection, and subsiding by sunset. North of the Santa Barbara channel islands and up to Point Reyes, northwesters occasionally reach 70 knots.

Another weather condition facing offshore operators in California is fog. South of Point Conception, fogs occur mostly in the autumn. They create serious navigational hazards

for supporting craft and require elaborate warning devices. Larger core-drilling vessels operating off the coast use radar extensively.

Drilling structures . . . Under California law, offshore operators must drill from either artificial islands or drilling platforms.

In either case, each offshore drill site must have provisions for a minimum of 20 wells.

Consensus is that the platform will be favored over the island, even though the state now has one completed island, another island nearing completion and only one platform under construction.

Platforms, it is felt, will be able in the long run to withstand the wave and wind conditions better than the islands.

The higher wave actions of the West Coast, however, make it more difficult to land platform legs on the ocean floor than in the gulf. Standard of California has engineered a plan to "pull" its platform legs to the ocean floor by means of cables attached to four 350-ft., 9⅝-in. piles driven around the platform.

Depending on the final well-spacing programs, which is consistently closer in California than elsewhere, operators probably will exceed the 20-well minimum in development drilling.

Directional drilling at extreme angles is common practice for Californians. At Huntington Beach, for instance, state tidelands leases have been developed from onshore drill sites by drilling with angles of inclination exceeding 75° for distances of nearly 2 miles.

A 1953 report by the National Petroleum Council on California's tidelands stated offshore structures probably would need to be designed so that the first deck level is at least 35 ft. above the high tide point and should be able to handle winds up to 75 miles per hour.

Actual experience . . . Except in the case of Monterey Oil Co.'s artificial island a half mile offshore from Seal Beach, California's tidelands development drilling has been done from onshore sites. However, the state's operators have gained considerable experience in offshore work in recent years with extensive core-drilling operations.

This work has been done almost exclusively from floating barges.

This experience shows that larger drilling barges like the CUSS I, where drilling is conducted through a hole amidships, have never experienced weather so bad as to require pulling off the location entirely and running for shelter. Occasionally, operator has had to pull out of the hole and stand by the location riding out the weather at anchor. This has occurred only three or four times a year and for time elapses rarely exceeding 36 hours.

The CUSS I has continued to operate in waves 12 ft. high for periods up to 48 hours. Union Oil Co., operator of the CUSS I, reports it has operated in waves higher than 8 ft. for 8 per cent of its total operating time.

The smaller over-the-side drilling barges generally have to pull off the hole and run for shelter in the lee of the channel islands when waves get higher than 8 ft.

Core-barge operators occasionally have had trouble getting supplies and changing crews when rough weather washed out small-boat operations. But this again has happened only three or four times a year and rarely for periods longer than 24 hours.

All told, these offshore core barges have lost only 10 to 15 days per vessel per year from bad weather.

Oil companies show no fear of the problems peculiar to drilling off California. And before the year is out, the companies will be unveiling some techniques to lick these problems.

Work to Start Soon on Line

LAUREL PIPE LINE CO. has awarded construction contracts for its 440-mile, 24 to 14-in. products line from Philadelphia area refineries to Cleveland. Work on the $50-million project is scheduled to start in April. Completion is due in August.

Here are the contractors:

. . . Missouri Valley Dredging Co., Omaha, Neb., Section 1, 5.6 miles of 24-in., from Eagle Point, N. J., to the west bank of the Delaware River, including the Delaware River crossing.

. . . Missouri Valley Dredging, Section 2, 20 miles of 24-in., from the west bank of the Delaware to Laurel's Booth station site in Delaware County, Pennsylvania.

. . . Engineers Limited Pipe Line Co., San Francisco, Section 3, 106 miles of 24-in., from Booth station to Mechanicsburg station near Harrisburg, Pa. Pipe Line Construction & Drilling Co. previously was awarded the Susquehanna River crossing and approaches consisting of 1 mile of 24-in. in Section 3.

. . . Panama, Inc., Houston, Section 4, 78 miles of 20-in., from Mechanicsburg station to Duncansville station.

. . . Panama, Inc., Section 5, 113 miles of 18-in., from Duncansville station to Aliquippa station in Beaver County, Pennsylvania, including crossings of the Allegheny and Ohio rivers.

. . . Williams Brothers Co., Tulsa, Section 6, 106 miles of 14-in., from Aliquippa station to Cleveland.

Laurel Pipe Line was organized last spring by Gulf Oil Corp., which owns 40 per cent; Sinclair Pipe Line Co., 35 per cent; and The Texas Co., 25 per cent. Its main gathering point and a tank farm will be located near Chelsea, Pa., in the Philadelphia area.

Initial capacity will be 100,000 bbl. per day, but this volume can be more than doubled with increased horsepower.

The 24-in. diameter on the eastern

section is the largest ever used for petroleum products. It tops the 20-in. Little Big Inch, from Houston to Moundsville, W. Va., which proved the feasibility and great economic advantage of large-diameter products lines in World War II.

Marketing terminals will be built at 13 locations on the line.

Price-Control Law

urged by California stations in a move to stop price wars.

WIDESPREAD gasoline price wars, which have been particularly severe in southern California, have provoked one of the state's leading service-station associations to ask for state laws regulating both wholesale and retail gasoline prices.

The Southern California Service Station Association went to State Atty. Gen. Edmund Brown last week with these proposals:

. . . **Put the entire petroleum** industry in California under the jurisdiction of a public utilities commission.

. . . **Call a special session** of the legislature to consider placing service stations under state price control.

In an effort to stabilize the market themselves, more than 400 serve yourself and multipump stations raised their prices from an average of 21.9 cents a gallon to 25.9 a gallon on regular gasoline. The hope was that the majors would then raise their prices to reinstate the usual 2 to 3 cents differential between independent marketers and major company stations.

Housebrand gasoline at major company stations has been selling at 25.9 cents a gallon and premium at 28.9 cents a gallon in the Los Angeles area in recent weeks. Normally, major housebrand sells for 29.9 cents and premium 34.9 cents.

Colorado Tax Bill Studied

THE COLORADO Legislature has killed one bill establishing state oil and gas severance tax, but a second measure is still alive.

The bill still pending sets no limit on the tax. The measure defeated last week placed a 5 per cent limit on the levy. If the pending bill is approved by the legislature, it will be submitted to the people in the November general election. The proposed bill also would deny producers the right to deduct ad valorem taxes paid to counties and other local districts.

Colorado now has a graduated gross income tax on oil and gas production. It has a 5 per cent limit.

Petrochem Outlay to Stay Up

. . . through 1959, annual study of Manufacturing Chemists shows. Three-year total to approach 1½ billion dollars.

THE U. S. CHEMICAL industry will spend about $2.54 billion for new plants and laboratories this year and next.

Under way now is $1.83 billion in new facilities, and $1.3 billion worth was spent in 1957.

These figures, compiled annually by the Manufacturing Chemists Association, Inc., do not show directly the share of petrochemicals in the total picture. But a state-by-state analysis indicates the investment in facilities for processing materials originally derived from petroleum and natural gas will run about $1.4 billion over the 3-year period 1957-1959.

On the MCA survey the investment allocated directly to petrochemicals runs only $451,440,000. But this covers only facilities for making basic chemicals from oil and natural gas. Such "first step" plants as ethylene, acetylene, BTX, and sulfur from refinery H_2S are included where these basic petrochemicals are sold for further conversion in other plants.

Not included are the synthetic-rubber and fertilizer facilities which today are very largely based on petrochemical feed stocks.

Also shifted to other categories are the plants making organic chemicals, plastics and resins and textile fibers. In many cases these plants too are based on petrochemicals. In Texas and Louisiana, both leaders in the chemical investment picture today, petrochemicals contribute to a heavy majority of these diverse operations.

Under organic chemicals, for example, MCA classifies plants making ethylene, BTX, and acetylene for further internal coversion to other products. New facilities for ethylene oxide, ethylene glycol, propylene oxide and glycol and similar petrochemical intermediates are also classed as organic chemicals.

Polyethylene, polypropylene and other similar plant investments go into plastics and resins. All ammonia facilities plus those for conversion to ammonium sulfate, ammonium nitrate, urea, etc. are classified under fertilizer chemical plants.

In segregating the share of plants working directly or indirectly on fractions from petroleum and natural gas, a conservative estimate of the 3-year program shows that the petrochemical industry, as we think of it, is spending over $1,400,000,000 for new plants.

MCA's final tally of all expenditures broken down according to this arbitrary classification, is shown in the table. The footnotes were added by the Journal to indicate the additional role played by petrochemicals.

Texas is the big leader among the states in future chemical development. The Texas total for the next 3 years is $864,780,000. Louisiana is second with $493,977,000, West Virginia third with $278,200,000, and California fourth with $188,686,000.

Other leaders are Illinois, $119,494,000; New Jersey, $154,965,000; Tennessee, $127,000,000; and Pennsylvania, $119,950,000.

WHAT'S BUILDING AND PLANNED IN CHEMICALS
(Thousands of dollars)

Category—	Planned	Under Construction	Completed	Total
Fertilizer chemicals*	45,575	50,500	114,800	**210,875**
Inorganic chemicals (gen.)	99,000	350,935	260,586	**710,521**
Organic chemicals† (general)	171,987	517,629	297,403	**987,019**
Metals	76,175	396,332	142,318	**614,825**
Petrochemicals‡	104,750	88,550	49,115	**242,415**
Plastics and resins†	151,500	101,820	198,120	**451,440**
Synthetic rubber*	18,050	145,230	134,500	**297,780**
Textile fibers	.....	91,000	70,000	**161,000**
Laboratories†	8,125	67,870	31,220	**107,215**
Miscellaneous	32,800	25,300	4,250	**62,350**
Totals	707,962	1,835,166	1,302,312	**3,845,440**

*Based largely on petrochemicals. †Based partially on petrochemicals. ‡Basic petrochemicals only.

PLASTIC spread on fabric is basis for . . .

SMOOTH SEAL inside repaired casing. It's . . .

A New Cold Patch For Casing Repair

Besides patching holes and splits, can replace squeeze cementing for sealing perforations and can be used to isolate short sections of open hole.

PAN AMERICAN Petroleum Corp. has come up with a casing patch similar to the well-known tire patch. It was developed and successfully tested for repairing holes in casing of oil and gas wells.

The company hopes soon to have the casing patch available for use throughout the world. Licensing negotiations with a number of oil-field service organizations are under way.

Pan American reports the patch is inexpensive and easy to apply to the inside of the casing. It is set in place by applying thermal-setting plastic to holes or splits in the casing.

The tool for applying this patch has only one principal part—an inexpensive inflatable mandrel. It is equipped with valves and two tubing centralizers. On it is wrapped fabric impregnated with the plastic. Diameter and length of the mandrel can be varied to fit size of casing and cover area to be treated.

How it works . . . Fabric strips are cut to length and width needed to cover the hole or split.

Catalyzed plastic is then spread on the precut fabric strips, and these are wrapped on the mandrel.

The area in the well to be patched is brushed by a wire scratcher. Then after attaching tubing centralizers to each end of the mandrel, the assembly is connected to the tubing and lowered into the hole to the proper depth.

Water or oil is pumped down the tubing string. This inflates the mandrel securely against sides of the casing, forcing excess plastic through splits or holes and forming a seal.

Under differential pressure, the plastic is squeezed through holes and rivets itself to the casing. Inside the casing a smooth sheet of reinforced plastic coats the walls.

The assembly is left in place 12 to 24 hours. During that time the plastic becomes extremely hard. The mandrel after that is deflated and removed from the well, and the repair is completed.

Its potential . . . The casing patch has important possibilities for production men:

. . . It doesn't materially reduce the inside diameter of casing.

A typical patch reduced inside diameter by about 6/10 inch. This will allow equipment, such as packers or clean-out tools, to move freely.

. . . It's simple to use.

The patch assembly can be prepared for running into the well in less than 30 minutes. All the tests were made by lowering the assembly into wells on tubing, but the system can be adapted to wire line tools.

. . . Potential applications are great.

The casing patch can replace cement squeeze jobs to seal perforations. It is possible to adapt the system for use in open-hole operations to isolate short sections of formation, eliminating the use of expensive casing. In well remedial work, in addition to sealing casing leaks, the patch can be used to seal off highly permeable streaks in open hole to control production or injection of well fluids.

The testing . . . Pressure tests on a typical casing patch show effective sealing of holes up to ¼-in. diameter at external pressures of 8,000 psi.

A sample of the patch material showed a tensile strength of 48,000 psi.

The patch was run in five wells by Pan American. It was successful in three where leaks were of the type anticipated. The patch was not successful in one because the casing was parted. In another the split was 2 in. wide and 4 ft. long.

Shale Oil Competitive

. . . with petroleum, Union official says. New pilot plant in California will refine jet and diesel fuels for Navy.

UNION OIL CO. of California has cut the cost of retorting oil shale to "considerably less than $1" per barrel of oil produced.

"Our new target is 50 cents per barrel," Union Vice President Fred L. Hartley told the National Western Mining Conference last week in Denver.

The cost cutting was achieved by simplifying some mechanical features and by increasing capacity of its Grand Valley, Colo., retort from 360 to more than 900 tons per day.

"Three years ago," Hartley said, "we were talking about the day when shale oil would be competitive with domestic petroleum. That day has come and gone. Today we are concerned only about getting shale oil onto a basis competitive with Middle East oil."

Hartley also said that Union's new experimental shale refinery at Brea, Calif., will refine trucked-in Colorado shale oil into jet and diesel fuels for use by the Navy.

How it works . . . The Colorado retort is a continuous, under-feed, countercurrent retort.

Crushed shale is fed upward from the bottom of the retort by a large ram-like piston serving as a rock pump. Previous designs called for gravity feed of charge stock to the retort.

As the shale is pumped upward, hot gases from burning residual carbon in the oil-shale ash at the top of the retort are pulled down past the rising shale by blowers. Oil and gas recovered from the shale are withdrawn from the bottom of the retort. Spent shale ash is spilled over into a chute.

The gas from the oil shale has a rating of about 2 million B.t.u. per ton of shale—about half as many B.t.u.'s as in the oil recovered. In a complete retort-refining setup, the gas could be used to produce process steam or heat for the refinery, or for steam generated electricity.

What comes out . . . The product Union has been getting from its Grand Valley retort is a black, viscous, waxy crude. It is a soft, slushy solid at room temperature. It cannot be transported, practically, by pipeline as it comes from the retort.

It consists of 50 to 65 per cent pure hydrocarbons with the remainder made up of sulfur, nitrogen and oxygen compounds.

In order to make the retort product into a commercial product, several steps are necessary. First, its pour point is lowered to 30° F. This is done in two stages:

. . . **The light ends** are removed by distillation. The heavier material is charged to a coker.

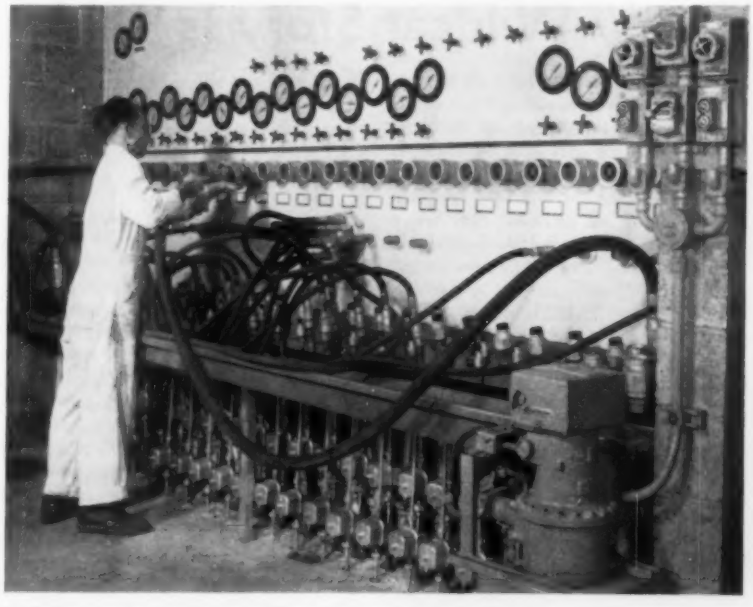
. . . **The coked shale oil** is then processed in a Unifining unit for removal of nitrogen.

Commercial products, such as 100-plus octane gasoline, can be manufactured in conventional catalytic cracking and reforming processes, Hartley reported. One valuable by-product is electrode-grade coke obtained by using a delayed coking process.

Aspeco experiment . . . Dr. Charles H. Prien, head of the chemical division of the Denver Research Institute, told the conference that the institute's experimental retort at Denver will soon move out of the basic pilot plant stage.

Prien said the 24-ton plant, which is experimenting with the Swedish Aspeco oil-shale process, will be converted into a more advanced demonstration plant. Operating data from the revised plant will be used as the basis for a semicommercial plant to be erected later in western Colorado by Oil Shale Corp., Beverly Hills, Calif.

Prien declined to disclose data on plant performance.



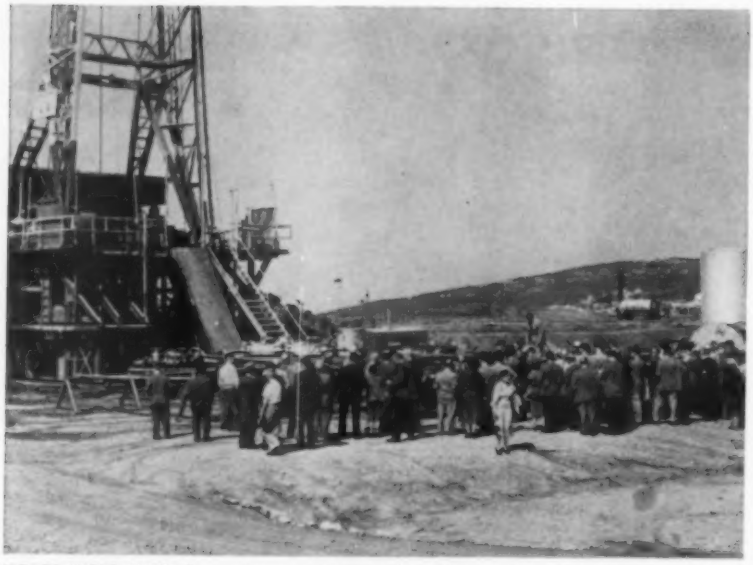
Blending Plan Aids Research

A KING-SIZE switchboard (above) is making motor-fuel blending an easy operation at the motor laboratory recently installed at Shell Oil Co.'s Emeryville, Calif., research center.

Merely by plugging in the proper jack, the operator can deliver fuel from any of 25 underground tanks to any of some 50 test engines. Also, fuel components from several tanks can be blended automatically to exacting specifications before going to the engine.

In the new $750,000 lab, Shell is carrying out basic and applied research on fuels and oils for the cars, aircraft, and rockets of tomorrow. In one large, sound-baffled room, 17 single and multicylinder engines automatically record the performance of experimental fuels that will be needed by new automobiles within 5 years.

In individual test cells, standard and advanced-design automotive engines run day and night, 7 days a week, duplicating road conditions to evaluate experimental fuels and motor oils.



HOPES WERE HIGH for a deep producer when these editorial writers saw Magnolia's 1 Sterba in Oklahoma. But the well was dry, and now the . . .

Costly Wildcat Story Is Told

MAGNOLIA PETROLEUM CO. last week scored a second important public-relations bullseye on its recent record-breaking dry-hole wildcat in Oklahoma.

The company came out publicly with a complete, detailed cost breakdown on the 1 Sterba-Ordovician, which set a new Oklahoma depth record of 20,446 ft. last September (OGJ, Sept. 30, 1957, p. 68).

Magnolia is one of the first oil companies to discard the producers' traditional course of zealously withholding such cost data.

Magnolia said the 1 Sterba cost the company and its partners a thumping $1,054,500—or about $4.25 an inch.

Here's the breakdown of expenses:

. . . **$84,000** for tangible items, some of which, like some pipe, may be salvageable.

. . . **$580,000** for drilling, location, and roads.

. . . **$37,500** for coring, fuel, surveys, and testing.

. . . **$245,000** for mud, chemicals, cement, and cement service.

. . . **$7,000** for trucking, perforating, and acidizing.

. . . **$31,000** for bits.

. . . **$70,000** for equipment rental and miscellaneous.

Why tell the story . . . Magnolia had a reason, and a good one, for circulating such cost information. If the man in the street doesn't realize how costly a dry hole can be and how many dusters are drilled in wildcatting, how can he be expected to understand why, for instance, oil's depletion allowance is needed?

The company in its disclosure of the 1 Sterba costs went a step further to bolster depletion. To take care of the lost capital poured down this one deep hole "would take the depletion allowance from about 658 average producing wells for an entire year."

Magnolia, as operator of the Caddo County deep test, bore more than 40 per cent of the total cost. Sharing in the rest were Phillips Petroleum Co., Gulf Oil Corp., Pan American Petroleum Corp., Phillips Chemical Co., Sunray Mid-Continent Oil Co., and Anderson-Prichard Oil Corp.

Anderson-Prichard dropped out at 18,000 ft. and Sunray Mid-Continent at 20,000 ft. The rest went all the way.

First try a success . . . Magnolia's decision to announce publicly the 1 Sterba costs was due partly to success of an earlier public relations effort involving the deep test.

Last October, while the Big Chief rig was still on location, Magnolia invited registrants of the National Conference of Editorial Writers then in session in Oklahoma City to visit the location and get an insight into oil operations.

About 125 of the editorial writers from all sections of the country took up the invitation and travelled by chartered bus, at Magnolia's expense, to see the Sterba (photo).

During the trip, the writers rubbed elbows with operating oil people and received a primer course in the why's and wherefore's of oil. The results were gratifying—final proof coming in the form of a sheaf of thank-you letters now in Magnolia files from writers over the country.

The effort, Magnolia thinks, was more than worth the cost.

Recovery Program

planned at Dakota's Tioga and Beaver Lodge fields.

AMERADA PETROLEUM Co. has announced plans for a major secondary-recovery program in North Dakota's big Beaver Lodge and Tioga fields.

The company and 20 other operators in the fields have asked the state industrial commission to authorize unitization, cooperative development, and pressure maintenance for the Madison formation in both pools. The commission is expected to hear the applications sometime early in March.

Amerada did not reveal estimated reserves involved or how much additional oil the operators expect to recover, except to say the program "will result in a very substantial increase in ultimate recovery."

However, since discovery of the two fields in 1951, thousands of wells have been drilled, and Madison reserves in that area have been estimated at more than 200,000,000 bbl. Amerada's 1951 discovery at Tioga marked the first production in North Dakota.

Water injection . . . Unit agreements between the operators provide for "injection of gas, water and other substances" depending on feasibility. However, the applications say the program would be kicked off by injection of water.

E. H. McCollough, president of Amerada, said that prolonged studies showed that "if we are to attain the greatest ultimate and economic recovery of oil from these two large pools, we must get this program under way at the earliest possible moment."

He cited declining bottom-hole pressure, increasing gas-oil ratios and water production, and the increasing number of wells which must be pumped.

Amerada has been busy digging deeper in Beaver Lodge, which is just south of Tioga. Recent successes include new producers in the Devonian found below 10,000 ft., and the Silurian, found below 11,000 ft. These successes are expected to lead to increased deep exploration in the old

fields of the Nesson anticline, extending north and south of Beaver Lodge (OGJ, Dec. 23, 1957, p. 36).

New Price Cuts

posted in local areas, though rates generally hold firm.

SEVERAL LOCALIZED price cuts occurred in Texas, Oklahoma, Ohio, and the Tri-State areas last week.

No one moved to meet a hefty 50-cent slash in West Texas sour crude prices posted by Eastern States Petroleum & Chemical Corp. the week before (OGJ, Feb. 10, p. 65). Only a small amount of crude was affected by the Eastern States posting.

However, Sinclair Crude Oil Co., a heavy buyer, cut its postings by 7 to 15 cents in parts of Texas and southern Oklahoma.

Sinclair reduced southern Oklahoma sour crude by 10 cents to a price of $2.95 for 40°-gravity and above. It cut Southwest Texas and Lower Gulf Coast light crude by 15 cents to a $3.20 level. Heavy crude in the same area dropped 15 cents to $3.30.

For North Texas (District 9), Sinclair reduced prices 7 cents in Cooke and Grayson counties.

In Ohio last week, Joseph Seep Purchasing Agency of South Penn Oil Co. posted a $2.72-per-barrel price for Corning Grade crude, down 5 cents. Joseph Seep cut the same crude by 13 cents on January 6 and by 7 cents last August.

The company said it made the new 5-cent reduction to meet competitive prices for Illinois Grade in the Tri-State area of Illinois, Indiana, and Kentucky. The other major buyer of Corning Grade, Ashland Oil & Refining Co., held to its price of $2.77, at least temporarily.

In the Tri-State area, the price settled more securely at the $3 level last week when at least three additional companies cut postings 5 cents. The Texas Co., Magnolia Petroleum Co., and Pure Oil Co. met the $3 price of the leading buyers in the area. Earlier the three firms and others had reduced their original $3.15 price by only a dime, while the major buyers, Ashland and Sohio Petroleum Corp., had cut 15 cents.

In Oklahoma, Anderson - Prichard Oil Corp. reduced its price by 10 cents-plus in Cement field of Caddo County. The company buys some 11,000 bbl. daily from the field.

Anderson-Prichard's posting set a price of $3.05 per barrel for 40°-gravity crude and above and a 3-cent differential downward for each degree of gravity. Previously the price was $3.15 and a 2-cent differential.

Pipeline briefs

Sinclair Oil & Gas Co. and Skelly Oil Co. are completing a 60-mile, 8-in. gas-gathering system linking six fields in Schleicher and Tom Green counties, West Texas, to their jointly owned gasoline plant in Hulldale field. Oil-well gas is being gathered from Mount Susan, Pecan Station, O'Harrow, Butler, Toenail Trail, and Otto fields. Tillery-Penn, Fort McKavett, and Neva West fields in Schleicher County will be connected soon.

Pioneer Gathering System, Inc., will purchase the gas and deliver it through a new 70-mile, 12 and 16-in. line to Permian Basin Pipeline Co., subsidiary of Northern Natural Gas Co. Permian, which has completed an 83-mile, 16-in. line, has a contract to purchase up to 200,000 M.c.f. daily when it is available, but initial deliveries will be 60,000 to 70,000 M.c.f. daily.

Westcoast Transmission Co., Ltd., is extending its gas-gathering system with 80 miles of 8, 10, 12, 18, and 20-in. along the Alaska Highway in northeastern British Columbia. The contractor, Dutton-Williams Brothers, Ltd., has clearing, grading, and stringing under way. The project is due to be completed in August, making additional gas available to the Peace River-Sumas, Wash., system, which started operating last fall.

Collins Construction Co. is working on several pipeline jobs in this country and overseas.

Its trenching contract for 26 miles of 6, 8, and 12-in. offshore gas gathering lines for the CATC Group will be completed this month. The system is in the Grand Isle, La., area. Collins is digging trench for 57 miles of 12, 16, 20, and 26-in. offshore line for Tennessee Gas Transmission Co. on the Kinders, La., line which will connect CATC supplies. This job will be finished in May.

Collins is laying 3 miles of 12-in. and 3 miles of 24-in. crude loading lines in the Persian Gulf, to be completed in April, for American Independent Oil Co.

Service Pipe Line Co. will start work next week on an extension of its new microwave system linking the LaPlata, Mo., and Manhattan, Ill., stations. Nine towers up to 420 ft. high will be constructed by Tower Construction Co. of Sioux City, Iowa, along the route of Service's trunk line to Chicago area refineries. The system at first will be equipped for 10 voice channels. It will operate in the radio frequency band of 6,700 megacycles. When it is completed this fall, unattended electric pump stations at Medill, Ormonde, and Streator will be controlled from Freeman, Mo.

Trans-Mountain Oil Pipe Line Co.'s scheduled deliveries this month reflect the reduced demand for Alberta crude through loss of some export markets and decrease in others. February throughput is expected to average 102,000 bbl. daily compared with 111,627 bbl. daily last month and 200,000 bbl. daily last spring.

Home Oil Co., Ltd., which acquired 12 per cent of the stock of Trans-Canada Pipe Lines, Ltd., last fall, has increased its ownership by purchasing additional stock from Hudson's Bay Oil & Gas Co., Ltd. The purchase of 94,228 shares from Hudson's Bay boosted Home holdings to around 797,000 shares. R. A. Brown, Home president, said his company also has the option to buy $1,190,000 in 5½ per cent subordinated income notes from Trans-Canada convertible at $15 per share.

Home's recent deals have made it the largest single stockholder in Trans-Canada, which will complete its 2,250-mile gas line from Alberta to Montreal next fall. Other principal owners are Canadian Delhi Oil, Ltd., and British American Oil Co., Ltd. (OGJ, Nov. 4, 1957, p. 80).

Also for Pipeliners . . .

IN THE NEWS: Chances for gas bill feared injured by publicity over Porter letter (p. 66) . . . Laurel Pipe Line has let construction contracts (p. 70) . . . Magnolia has completed expansion of its trunk-line capacity out of West Texas (p. 76) . . . Brown & Root launches new pipelaying barge (p. 79) . . . Alaska Juneau Gold Mining Co. buys out firms promoting Oklahoma to St. Louis gas line (p. 79) . . . Rebel attacks on Saharan pipeline and railroad are proving headaches to French (p. 81) . . .

PLUS THESE TECHNICAL REPORTS: Predicting pressure drop in gas-condensate pipelines (p. 108) . . . Pipeline construction report (p. 139).

THIS SCENE should make West Texas producers happy, because . . .

Magnolia's New Line Is Ready

MAGNOLIA PIPE LINE CO. has completed a 75,000-bbl.-daily expansion of its trunk-line capacity for crude oil out of West Texas.

In a project kicked off last spring, Magnolia laid roughly 250 miles of 12, 14, 16 and 20-in. pipe and added more pumping capacity to its existing lines between Midland and Corsicana, Tex. The new pipe went principally to filling in loops.

Completion of the program increases the company's crude capacity out of West Texas to 235,000 bbl. daily from the old top of 160,000 bbl. daily.

Throughput now is about 200,000 bbl. daily. This gives a small capacity cushion. But this, the company thinks, will melt away rapidly when crude-oil demand begins to catch up with the present oversupply.

Company engineers say all new line now has been water tested and filled with oil. Only work remaining in West Texas is making minor connections at the Midland and Corsicana tank farms.

Construction contractors were H. B. Zachry Co. and O. R. Burden Construction Corp.

More work this year . . . Expansion of West Texas system also will necessitate increasing capacity of the company's trunk system extending south from Corsicana to its Beaumont refining center, and this work will start within 2 months.

The Corsicana - Beaumont section currently can handle only 175,000 bbl. daily. Magnolia Pipe Line plans to add new pump stations at Bragg and Grapeland, Tex., and expand pumping capacity at an existing station. This work will boost capacity of the section to 235,000 bbl. daily on a par with the West Texas section capacity.

The work is slated for completion this year.

Wilshire Sells Out

to Pontiac. Market outlets, California refinery involved.

PONTIAC REFINING CORP., Corpus Christi, is expanding its operations to the West Coast and taking its first step into retail marketing of products.

Edwin Singer, Pontiac president, announced last week that a subsidiary, Pontiac Western Corp., has completed arrangements for the acquisition of Wilshire Oil Co. of California and Wilshire Products, Inc.

Wilshire Oil, headquartered in Los Angeles, operates a 30,000-bbl. refinery at Norwalk, Calif. Wilshire Products, primarily a marketing firm, sells products under the Wilshire name through nearly 500 service stations in California.

Pontiac also has refineries at Corpus Christi and Purvis, Miss. Although Pontiac has been in the producing and refining business for years, a company spokesman said the Wilshire purchase marks its first expansion into the retail marketing field.

—*Processing* briefs

All units are now on stream at El Paso Natural Gas Products Co.'s new refinery at Ciniza, N. M. The last to go on stream was the 1,600-bbl. hydrofluoric acid alkylation unit. Other units at the 8,000-bbl. plant east of Gallup were put into operation in December, 14 months after construction was started (OGJ, Dec. 23, 1957, p. 50). The plant will process crude from the San Juan basin. Products will be sold through El Paso and Dixie brand retail outlets in Colorado, Utah, New Mexico, and Arizona.

Canada's Polymer Corp. will spend $10 million on expansion and process improvements this year. The program consists of a new plant in Western Canada, completion of a research lab, expansion of butadiene facilities to accommodate increased supplies of raw material from Sarnia, new latex facilities, and an improved effluent disposal system.

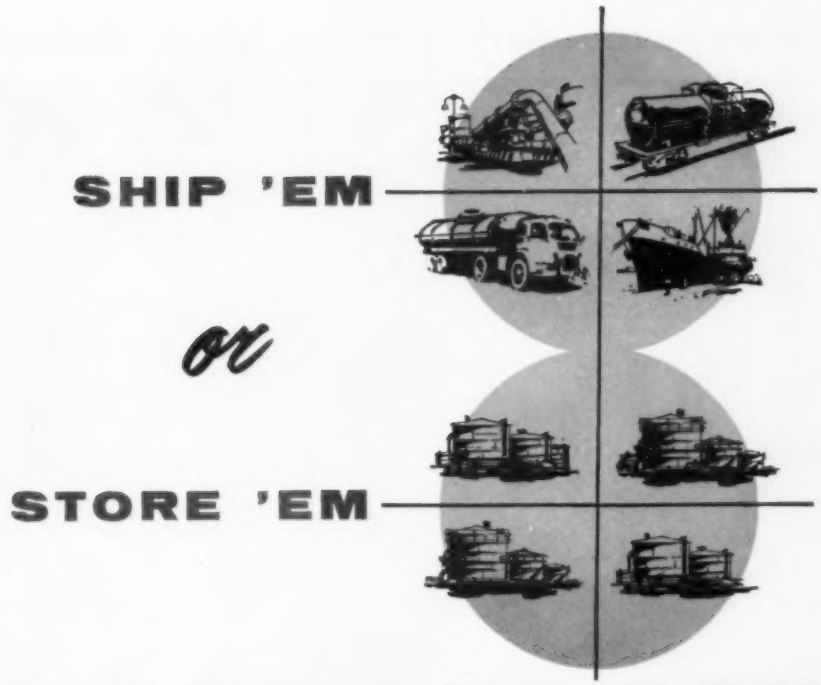
A new testing method has been devised to show the difference between virgin and reclaimed oils. Armour Research Foundation of the Illinois Institute of Technology developed the technique by shooting infrared rays through the oils. The Foundation found statistical differences sufficient to identify them. The Pennsylvania Grade Crude Oil Association sponsored the study.

Girdler Construction Division of National Cylinder Gas Co., Chicago, has been awarded a $3.4-million contract to design and build units to produce and purify hydrogen, nitrogen, and carbon dioxide. The units will be located at the Callery Chemical Co.'s high-energy fuel plant now being built at Muskogee, Okla.

Also for Refiners . . .

IN THE NEWS: Cabinet fuels committee will meet in a few days to review the entire imports-control program (p. 64) . . . Southland is delaying plans for new Tampa, Fla., refinery because of restrictions on imports of Venezuelan crude (p. 65) . . . Petrochemical-plant investment will run about $1.4 billion over the 1957-59 period, survey shows (p. 71) . . . Union Oil has cut retorting cost of shale oil to less than $1 bbl. and now is shooting at a 50-cent mark (p. 73). . . . Pontiac Refining is expanding to the West Coast by buying Wilshire interests (p. 76) .

PLUS THIS TECHNICAL REPORT: Air-pollution control (p. 87).



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Fuel oil at *left* is fresh from refinery, bright and clear. *Center*, Nalco-treated oil is bright and sludge-free after four months. *Right*, untreated sample in four months time has darkened considerably, already begun to sludge.

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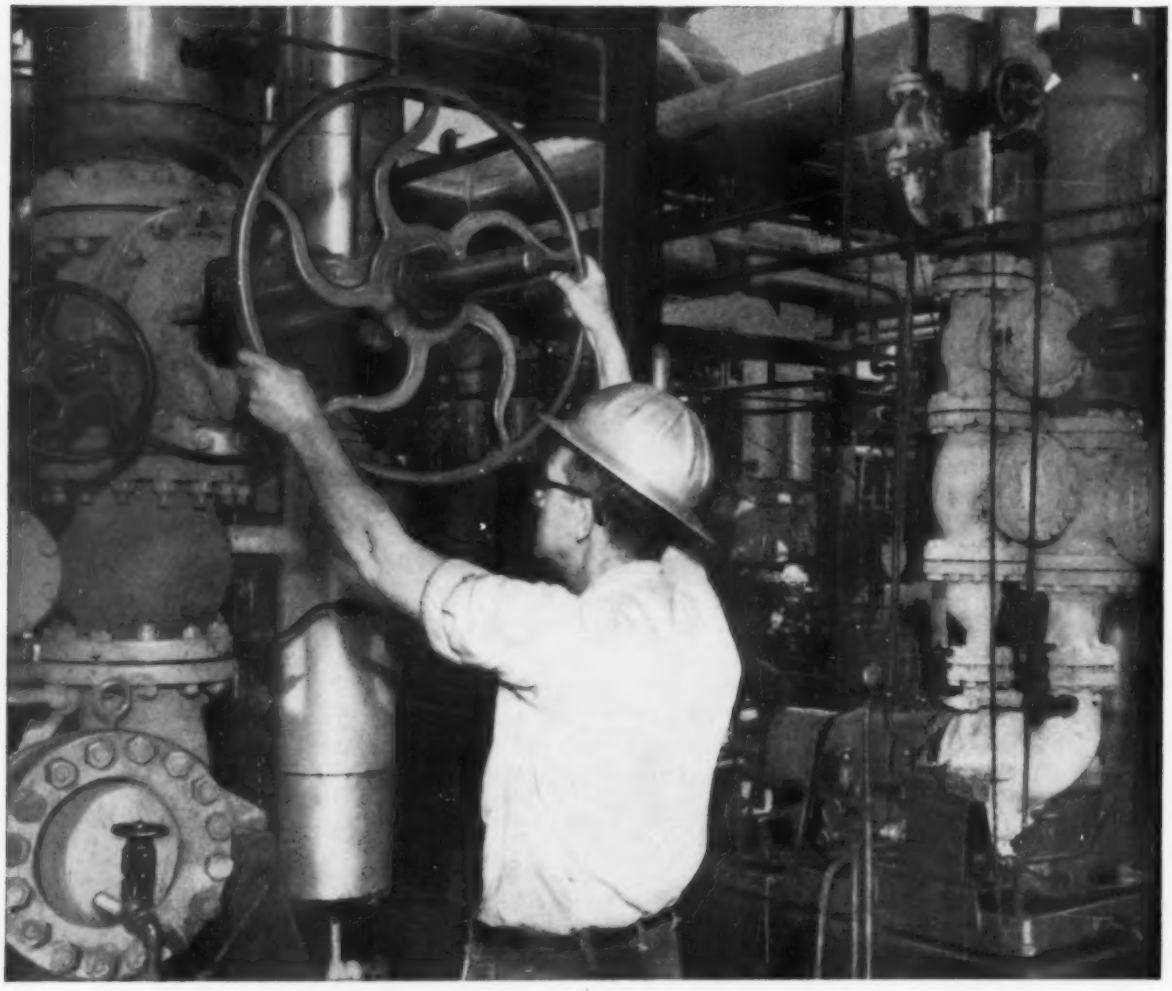

14 years on 680° F. bottoms handling ... still no repairs on these valves

These 300-pound Crane steel gates and checks were installed in The Cities Service Refinery Corporation at Lake Charles, Louisiana in 1943.

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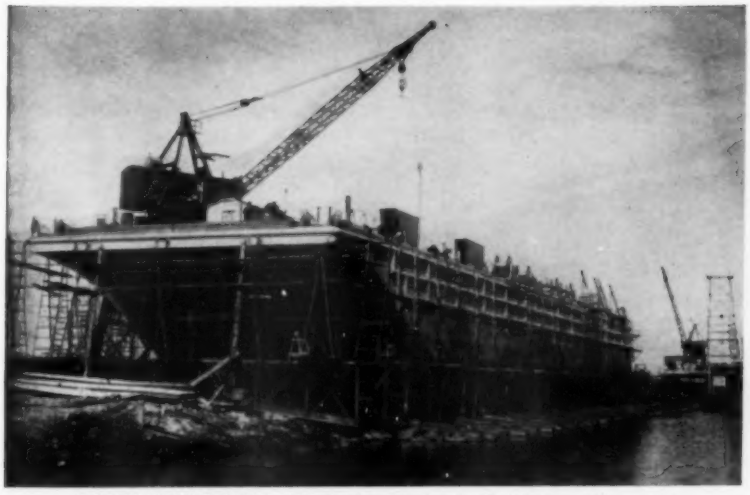


LATEST EQUIPMENT is fitted aboard the L. E. Minor and a new . . .

Pipelaying Barge Is Launched

THE L. E. MINOR, a 4,500-ton pipe-laying barge complete with a traveling gantry crane, has just been launched by Brown & Root, Inc.

Designed to be virtually self-sufficient on the job, the new $2.5-million vessel is equipped to drive pi.ing and can raise and lower pipe over the side without additional aid.

Pipe-handling equipment includes an automatic stalking device for moving the pipe across a rack and onto hydraulically operated line-up pads. An operator at a console can spin the pipe and raise and lower it as desired before welding the stringer bead. Other hydraulically operated roller pads along the work ramp are used to position the pipe to any degree of curvature desired as it rolls along the inclined ramp.

The barge, named for Ed Minor, vice president of Brown & Root's pipeline division, was built by Levingston Shipbuilding Corp., Orange, Tex. It is 350 ft. long, 60 ft. wide, and 22½ ft. deep.

With the exception of material transportation and a stand-by tug for moving anchors by which the barge pulls itself forward, the vessel is self-sufficient. The gantry crane can travel 320 ft. along the deck on tracks, and its 120-ft. boom makes it possible to reach over the barge at any spot to handle any necessary lifting jobs.

Mining Firm Enters Gas Deal

. . . by acquiring two companies proposing pipeline from Oklahoma to St. Louis. FPC filing is being revived.

PROMOTERS of a gas line from Oklahoma to St. Louis have sold out to Alaska Juneau Gold Mining Co., Los Angeles.

Alaska Juneau, an old mining company with hydroelectric-power interests in Alaska and manufacturing interests in Missouri, has purchased Mookl Chemical & Gas Corp., Tulsa, and Missouri Transmission Corp., Springfield, Mo.

The two companies had proposed a 425-mile, 16-in. line from Central Oklahoma to the St. Louis area with initial throughput of 100,000 M.c.f. daily and ultimate capacity of 300,000 M.c.f. daily (OGJ, Dec. 2, 1957, p. 61).

Their initial filing with the Federal Power Commission was not supported by firm reserves, market, engineering, and cost data. It was rejected as being under an old procedure which is no longer acceptable (OGJ, Dec. 30, 1957, p. 114).

The new project backers announce they have hired consulting engineers to evaluate reserves which they say are signed up or committed. A new FPC application is to be filed within a few months.

G. E. Cannon, who will be a vice president of Mookl, is the only member of the original Mookl and Missouri groups retained under the new setup. Mookl was headed by Victor J. Hermel, St. Paul, and Eugene Williams was president of Missouri Transmission. New oficers are expected to include Oklahoma and Missouri industry figures.

Alaska Juneau profile . . . Alaska Juneau is headed by C. J. Ver Halen, Jr., as president.

He is also a magazine publisher, a manufacturer, financier, and a producer of motion pictures and television films.

He took over the company after a proxy fight in 1955-56 which climaxed several years' unprofitable operations by Alaska Juneau. A new board was elected in June 1956. The first year under Ver Halen's leadership, the company showed a profit.

Besides Ver Halen, Alaska Juneau officers are Ted Sargent, vice president; J. J. Malone, vice president; Robert C. Hill, treasurer; J. J. Brandlin, secretary and general counsel; and Bruce Gilreath, assistant to the president and assistant secretary-treasurer.

Sargent is chairman and chief executive officer of Sargent Engineering Co., oil-country suppliers. Malone is president of Wilshire Federal Savings and Loan Association. Hill is vice president of Hill, Richards & Co., stock brokers. Brandlin is a member of Vaughan, Brandlin & Baggot, attorneys. Gilreath has had experience in oil-industry finance and tax matters. All live in Los Angeles.

Spread Is Assigned

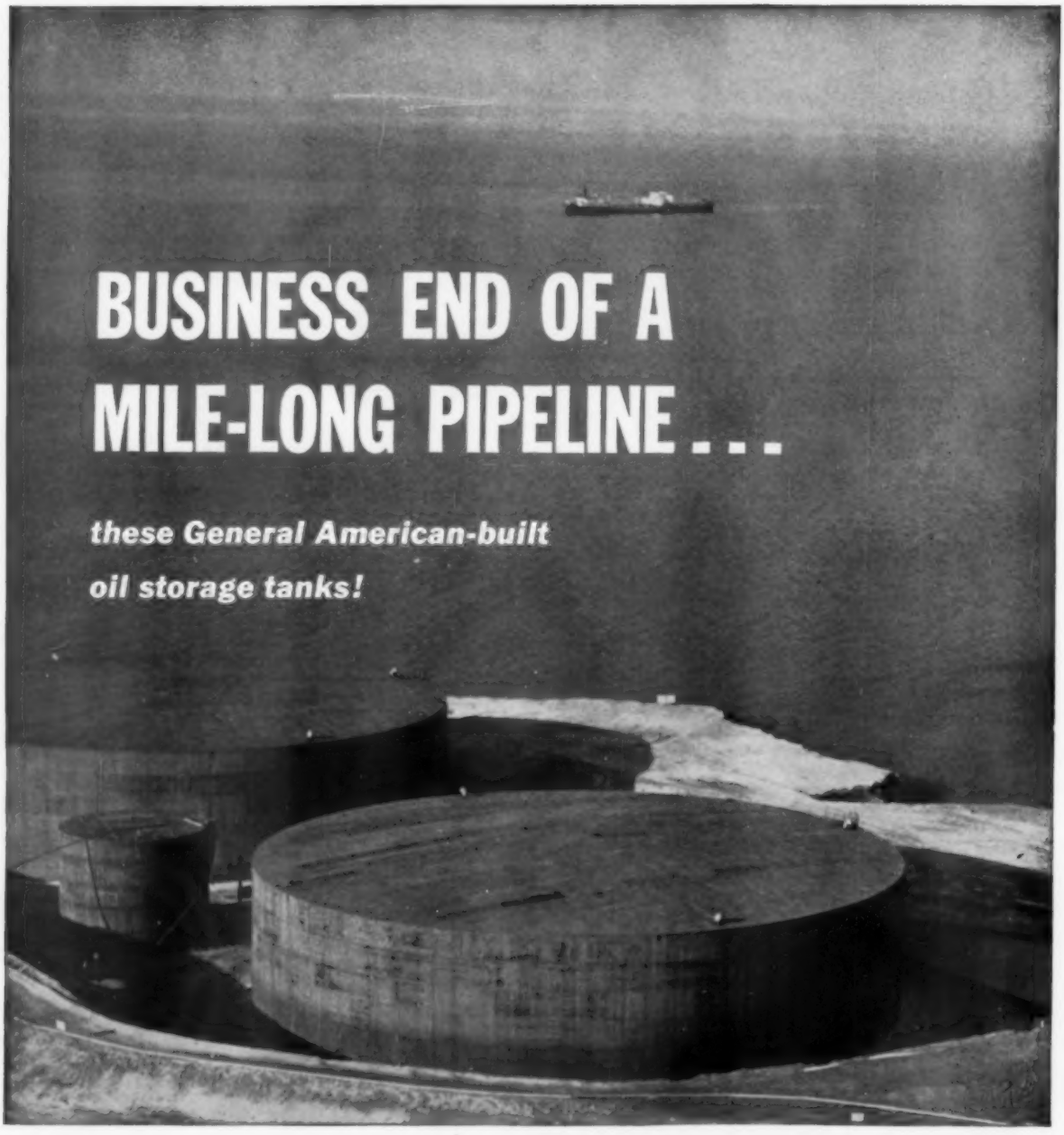
in Denver Julesburg basin to independent by Sohio.

SOHIO Petroleum Co. has assigned its leases on more than 106,000 acres in the Denver Julesburg basin to Harold Green, San Francisco operator.

Green took the assignment without cash consideration. He assumed lease obligations and plans a 10-well wildcat program plus an evaluation program on the entire spread within 18 months. Sohio retained a small overriding royalty interest.

Green already has opened offices in Denver and plans to start on the evaluation program soon. Acreage is scattered throughout the basin in Phillips, Washington, Yuma, Weld, Logan and Morgan counties, Colorado; Platte and Goshen counties, Wyoming; and Morrill, Banner, Scottsbluff, Garden, Kimball and Deuel counties, Nebraska.

Sohio recently closed its Denver offices and reportedly gave up its undeveloped leases in the Denver Julesburg basin because they were scatttered too far to handle from its existing Casper and Billings offices.



Moored more than a mile offshore in 70 feet of water, even the world's largest tankers (or any tanker presently contemplated) can deliver cargoes direct to these twin 268,000-barrel storage tanks . . . eliminate double handling and costly barging charges.

Each 200 feet in diameter, 48 feet in height, the tanks were custom-engineered, erected on the site by General American's Plate and Welding Division for Northville Dock's new Long Island Terminal. New York State's largest tanks . . . they provide storage for 22,500,000 gallons of oil.

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UNSMILING French officials witness a "victory." They've found . . .

Sahara Oil Is Headache

. . . because of rebel attacks on pipeline and railroad. But production at Hassi Messaoud rises with new completions.

LOOKING just a little on the grim and serious side, French Minister of the Sahara Max Le Jeune (above) and a group of equally serious military and civil officials greet the first Sahara oil at the halfway point on its journey to the Mediterranean coast.

Last week the French had still not been able to move even a full tanker load of the Hassi Messaoud crude to Philippeville for transportation to a French refinery. Trying to evade fast-moving Algerian nationalist saboteurs has made it a slow job.

At the point pictured here, the real job begins. The valves at the right in the picture are the northern end of the hastily built 6-in. pipeline from the Hassi Messaoud field to Touggourt, the railhead. The pipeline can move only about 190 bbl. an hour of the Saharan crude.

An even bigger bottleneck in the operation are the railroad tank cars in the background. From Touggourt north to Philippeville on the Mediterranean coast the oil is moved by rail. The cars each carry about 440 bbl. of crude, but so far the French have moved only about four cars on each train, always accompanied by an armored car loaded with troops.

The Algerian nationalists have blown up the railroad at least three times in as many weeks as it winds through the rough Atlas mountains in northern Algeria. So far, the French say, the saboteurs have missed the oil cargoes each time. But, each time it happens, the road must be repaired.

At the present rate of movement it will take the French another 2 weeks to push enough oil into the storage at Philippeville to fill even a small tanker.

New Hassi Messaoud wells . . . The two French companies developing the field supplying this crude now have nine producing wells in the field.

Officials of Cie. Francaise des Petroles d'Algerie and SN REPAL said in Paris last week that four more wells have been completed. No details of production tests were given, but the new completions "increase considerably" the reserves for the field, according to the French.

The two companies now have a southwest-northeast trend more than 13 miles long and more than 11 miles wide. One of the new completions, OM 81, is about 8 miles north of the Hassi Messaoud discovery. All nine wells will produce from below 11,000 ft.

Pipelines . . . While the French companies continue to drill feverishly to develop the reserves already found in the Sahara, pipeline plans to take the crude north are moving much more slowly.

The Hassi Messaoud bottleneck will continue to exist until the planned 24-in. line from Hassi Messaoud to the Mediterranean port at Bougie can be built. Even the most optimistic French sources concede this is at least 2 years away. Even then the line is sure to be harassed by rebel activity unless the French can settle the Algerian problem. Last week that appeared to be even further in the future than it has been.

An official spokesman for the government's Bureau de Recherches des Petroles admitted in Paris that American financing may come into the picture for the Sahara's second pipeline. The spokesman would give no details but said negotiations now are under way with financial groups in the United States for a line from Edjele field north to the coast.

Edjele was the first oil discovery in Algeria. Since that time, Cie. de Recherches et d'Exploitation de Petrole au Sahara (CREPS) has drilled 20 wells at the field and located promising fields about 40 miles away (OGJ, Feb. 10, p. 86).

The obvious route for a pipeline to service this region would be north and east through either Tunisia or Libya to the Mediterranean. Tunisia has said it would welcome such a pipeline through its territory. But that was before the bombing raid staged by French planes on a Tunisian village last week.

Cuban Well Below 11,538 Ft.

A NEW DEPTH RECORD in Cuba has served notice that the island still is one of the prime exploration areas in the Caribbean.

Cuban Kewanee Oil Co. is drilling ahead at 11,538 ft. at Collazo 1, located in its Punta Alegre concession on the north side of the island. This beats the old record set in 1951 when a Gulf Oil Corp. subsidiary drilled Blanquizal 1 off the north shore of Cuba to 11,218 ft. The Collazo test is projected to 13,000 ft. Gulf Oil has an interest.

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Aramco Finds New Pay Zones

. . . between 7,600 and 8,300 ft. in offshore discovery. Zones are not productive elsewhere in Saudi Arabia.

ARABIAN AMERICAN Oil Co. has found new oil-producing zones in its tests of the company's second offshore oil field in the Persian Gulf.

After almost 2 months of tests in Manifa 1, Aramco last week cautiously disclosed that it is now testing zones that do not produce anywhere else in Saudi Arabia. The company did not name the new productive zones, but said they are between 7,600 and 8,300 ft. and lie between the Lower Cretaceous Zubair sandstone and the Jurassic limestone Arab zone, the country's most prolific formation.

Aramco would give no flow figures on any of the zones tested, but did say that the A, B, and C members of the Arab zone are all productive at Manifa. The well has been drilled to 9,637 ft., and all these limestone zones are below those now being tested. The D member of the Arab zone, which accounts for more than 80 per cent of Saudi Arabia's 1,000,000-bbl. daily produtcion, is dry at Manifa.

Both the Bahrain limestone and the Zubair sandstone were also dry at Manifa. These two Cretaceous zones both produce at Safaniya, Aramco's first offshore field 20 miles to the north of Manifa.

Before the company made its first drill-stem test of the A member of the Arab zone in December it found shows of oil in the Sulaiy limestone just above the anhydrite cap rock of the Arab zone. The Sulaiy is not productive in any other Saudi Arabian fields.

Above the Sulaiy limestone is Saudi Arabia's Yamama formation, a calcarenite alternating with fine-grained limestone. It is the equivalent of the Ratawi zone which is productive in the Neutral Zone. There have been shows in the Yamama in Saudi Arabia in the past but it has never before proved to be productive.

New Maracaibo Discoveries

. . . test 4,000 bbl. daily. Phillips producer is first on 25,000-acre block. Signal makes second discovery.

THE SEARCH for oil in Venezuela's Lake Maracaibo has paid off again. Phillips Petroleum Co. has brought in the first discovery on Block 10, and Signal Oil & Gas Co. of Venezuela has completed its second flush producer in Block 4.

Phillips' LSG-O-1 flowed at a rate of 4,080 bbl. daily through ¾-in. choke from the Eocene. No test was made through open tubing. The well is the first test on a 25,000-acre concession purchased last spring and owned jointly by six companies.

Phillips said a drilling platform has already been erected for a second wildcat about 9 miles east of the new discovery. The combine has also staked an offset to the new discovery. Drilling on both wells will start immediately.

The new Phillips discovery is on a block owned 45 per cent by Phillips; 25 per cent by San Jacinto Petroleum Corp. and associates; 10 per cent each by El Paso Natural Gas Products Co. and Western Natural Gas Co.; and 5 per cent each by Sunray Mid-Continent Oil Co. and Pacific Petroleums, Ltd.

Signal's well . . . North of the Phillips discovery, Signal, operator for a four-company combine of newcomers to Venezuela, completed its second flush wildcat in Block 4.

The Centro 3-X is even better than the first successful well drilled by the combine.

Centro 3-X flowed 4,000 bbl. daily of 41.3°-gravity crude. The company revealed no information about its productive zone. The well is about ¾ mile northwest of Centro 2-X, which tested 2,400 bbl. daily in November, and 3¼ miles southwest of Signal's first well, Centro 1-X, which was suspended in July at 9,470 ft.

The Centro 2-X pay came from a 70-ft. sand section between 12,113 ft. and 12,183 ft. The company found a total of 350 ft. of productive sand above that tested.

The wells are on a 27,600-acre concession owned jointly by Signal, Pure Oil Co., Standard Oil Co. (Ohio), and Hancock Oil Co.

Other successes in the central part of the lake since the first of the year include the SVS-4 in Block 1, drilled by Sun Oil Co. for a three-company combine, and Superior Oil Co.'s Lama 2 on the company's 7,774-acre concession north of Block 1.

Nigerian Strike

made by Shell-BP as first crude exports start moving.

A THIRD PRODUCING oil field in Nigeria is indicated in a discovery of Shell-BP Petroleum Development Co. of Nigeria, Ltd.

The new field is at Soku in the Niger River Delta southeast of Oloibiri field. The discovery was made below 10,000 ft. Other details were not revealed by Shell-BP.

The discovery well was brought in on the eve of first export shipments of crude produced in testing new wells at Oloibiri and Afam fields in Nigeria. The shipments will clear storage and allow Shell-BP to test more fully the potential of the wells.

Crude from production tests on four wells at Oloibiri is being barged to Port Harcourt. The company next month expects to complete a 65-mile, 8-in. test pipeline to handle the production.

A 30-mile, 6-in. test line from Afam field to Port Harcourt also is nearly ready.

The four Oloibiri wells and the three Afam wells are each being produced on test rate at 1,000 bbl. daily.

Two other wildcats are drilling ahead at Ossioma, about 100 miles northwest of Oloibiri, and at Ikpe, about 40 miles northwest of Afam. The company may spend $30 million this year in its Nigeria play. Six rigs are now active and four more may be drilling by the end of the year. A drilling tender will start its first test soon in tidal swamps (OGJ, Jan. 20, p. 103).

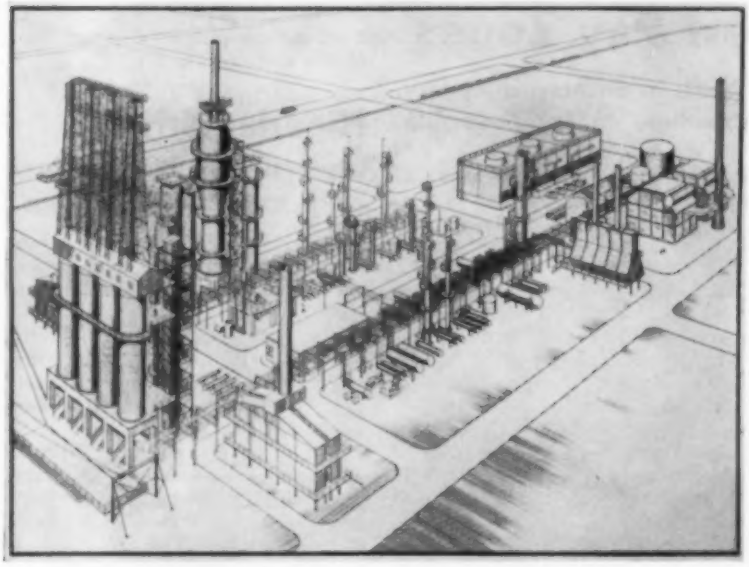
German Barge Goes to Paria

THE SECOND drilling barge built in West Germany will be headed for Trinidad by the end of February.

The 2,200-ton barge was ordered by Trinidad Northern Areas for drilling in the Gulf of Paria. It is a submersible type, similar to the first built in a German shipyard. This was the Adma Enterprise, now drilling its first well in the Persian Gulf.

After the tow across the North Atlantic, the new barge will be set up on an offshore concession where TNA now produces 2,000 bbl. daily from three Soldado field wells.

TNA, owned by British Petroleum Co., Ltd., Royal Dutch-Shell, and The Texas Co., was the first company to start offshore drilling in Paria waters.



NEW UNITS will hike capacity at Lujan. After 2-year lull . . .

Argentina to Expand Refinery

THE ARGENTINE Government has approved a $24-million expansion program at its Lujan de Cuya refinery in Mendoza Province.

The move gave the state oil agency, Yacimientos Petroliferos Fiscales, authority to close a contract with M. W. Kellogg Co. for the project. The program may take 5 to 6 years to complete.

Expansion at the 11,300-bbl. plant will include a 28,000-bbl. crude unit, an 18,500-bbl. delayed coker, and an 11,000-bbl. Orthoflow catalytic cracker and gas recovery unit.

Feed stocks for the expanded plant will be Barrancas crude, a waxy, low sulfur-content crude produced in the nearby area, east of the Andes Mountains. Products will include high-octane gasoline, kerosine, tractor fuel, fuel oil, LPG, and coke.

Kellogg expects engineering work to begin this spring. Plans call for processing materials from France and from local Argentine industry.

The decision to go ahead with the Lujan expansion was the first step in refinery construction since the Peron Government fell 2 years ago. Since then, YPF has concentrated most of its resources on pipeline construction and drilling in its program to overcome the severe shortage of domestic crude production.

Last year, contracts were let for a 1,015-mile, 24-in. natural gas line from Campo Duran to Buenos Aires and for a 580-mile, 12-in. crude line from the same field to San Lorenzo.

This year, bids have been asked on a 390-mile crude line from fields in Neuquen Province to Bahia Blanca.

Besides its own drilling program, YPF also had awarded a contract for 40 development wells on Tierra del Fuego to Laughlin-Porter Drilling Co., Midland, Tex.

But early this month, Phillip E. Laughlin Jr., president of the firm, said the contract had expired due to the failure of the Argentine Government to post bond as required by the contract. If the drilling program is to go ahead, a new contract will have to be negotiated (OGJ, Feb. 10, p. 85).

Austrian Wildcat Finds Oil

A JOINT Socony Mobil Oil Co., Inc.-Royal Dutch-Shell company has brought in its second discovery on a concession in northwestern Austria.

Rohoel-Gewinnungs, A.G., tested Wegscheid 1 at the rate of 80 bbl. daily from Eocene pay at 8,725 to 8,794 ft. Total depth of the hole is 10,388 ft., the deepest well so far drilled in Austria. The find is located in the Voecklabruck area, northeast of Salzburg. RAG will put the well on production as soon as a pump is installed.

The only other discovery in the concession, a part of the Molasse basin, was made at Puchkirchen 2 years ago. Puchkirchen 1 is producing about 100 bbl. daily on pump from basal Tertiary sand at 8,465 ft.

Venezuela Plant

will be built by Socony to tie in with Barinas crude line.

SOCONY MOBIL Oil Co. de Venezuela will start work soon on a 40,000-bbl. refinery at the Caribbean terminal of the new Barinas-El Palito crude pipeline.

The $28-million plant will be wholly owned by Socony Mobil. It is expected to be completed late in 1959. The El Palito site is about 8 miles west of Puerto Cabello.

Company spokesmen called the refinery project evidence of Mobil's confidence in its future in Venezuela.

The 211-mile, 20-in. line from Barinas and San Silvestre fields opened in November with an initial throughput of from 40,000 bbl. to 60,000 bbl. daily. Socony Mobil and Sinclair Venezuelan Oil Co. own the line.

Process equipment at the new refinery will include a crude distillation unit with complete stabilization platinum catalyst reformer, and equipment for gasoline blending and treating. The plant design will have provisions for future expansion.

Feed will come initially from the company's San Silvestre field, but the refinery will be able to handle other available crude.

Philippine Oil Deal

made by Gulf. Refinery to be owned by local interests.

IF THE Philippine Government approves, Gulf Oil Corp. will furnish the crude for a 10,000-bbl. daily refinery to be built on Luzon by Philippine interests.

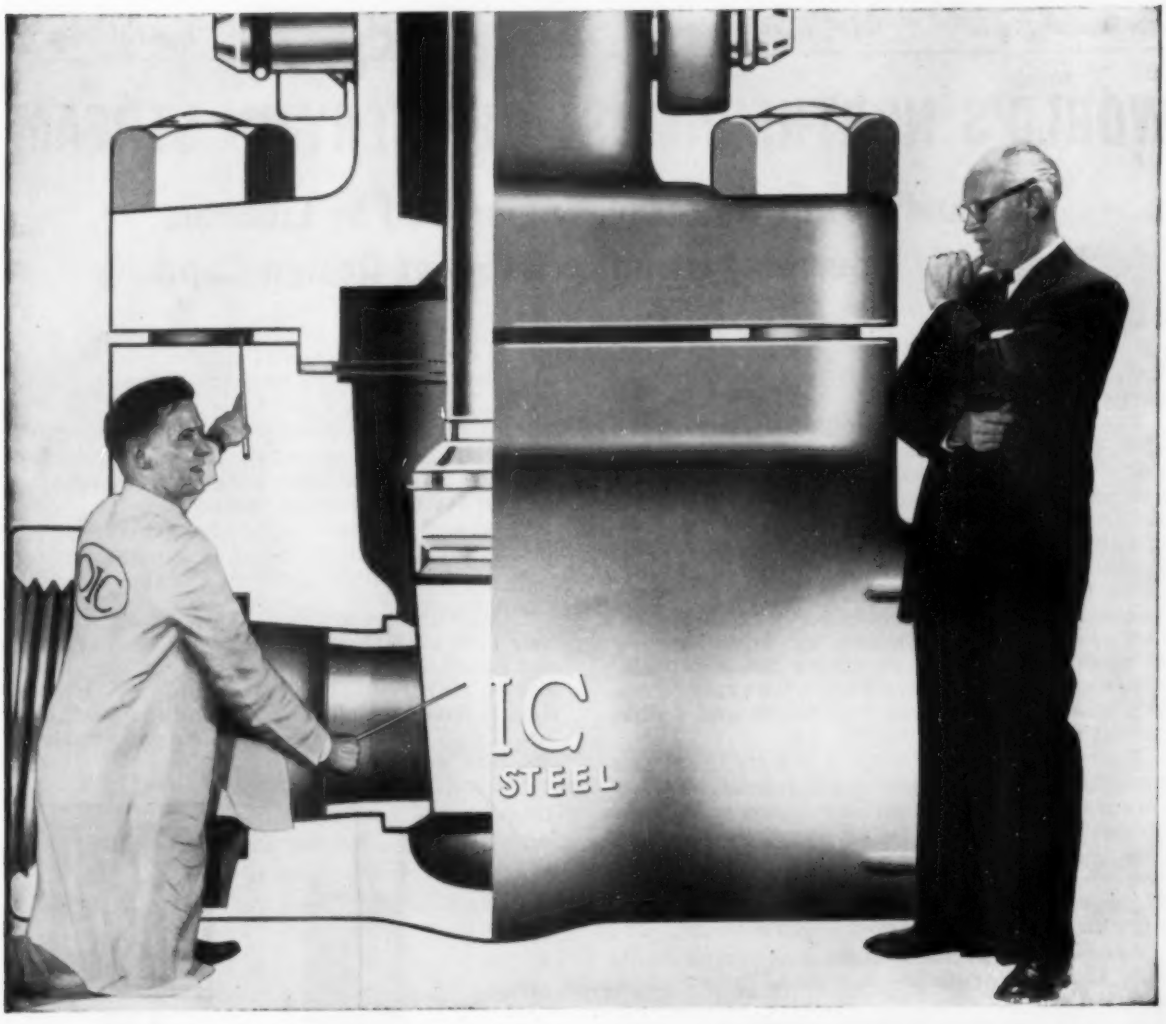
Gulf said last week it has signed a contract with Philippine Investment-Management Consultants, Inc., to supply the crude. The Philippine firm plans to form a refining and marketing company controlled by Philippine interests.

Gulf said the planned refinery will be completed in late 1960 or early 1961, if the government sanctions the deal.

Such a locally owned refinery would be the first for the Philippine Islands. Caltex now operates the only refinery in the islands. Its 18,000-bbl. refinery at Batanga on Luzon's southwest coast went on stream in 1954.

The Philippine National Economic Council gave its approval for a 20,000 to 25,000-bbl. refinery planned by Standard Vacuum Oil Co., only a few months ago.

...and you can see here....and here, sir, how we've killed maintenance problems on our new forged steel lines.



We stop galling and erosion by giving you 13% chrome stainless steel trim with wedges *duracased* to a rugged *1000 Brinell hardness*.

The square and *bolted* body-bonnet joint makes it easy to service the valve quicker. And it's a tighter joint, made doubly leakproof by recessing the soft iron gasket into the body. The gasket can't blow!

And you get the fastest joint make-up you've ever seen. Look at those pipe ends. See the extra wrench-gripping area and lugs. See how body-bonnet flanges are out of the wrench's way. No time lost here!

These new 600-lb. OIC forged steel valves are available with either *high-flow* ports (1300 line), or *standard-flow* ports (1100 line). Call your OIC Distributor, or write for specification literature.

The Ohio Injector Company • Wadsworth, Ohio

OIC VALVES | BRONZE, IRON, FORGED AND CAST STEEL, LUBRICATED PLUG VALVES

LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

385 Madison Avenue New York 17, N. Y.

WORLD'S NORTHERNMOST REFINERY ON STREAM

Finland's First Refinery, Engineered by Lummus, Now Fully Operating at up to 115% of Design Capacity

Finland's new Neste Oy refinery, designed to handle a mixture of 18,500 B/D of Middle East and Russian crude oil, or 19,200 B/D of Russian crude alone, is now on stream.

Located at Naantali, near the southwestern port of Turku, the new refinery includes the following units: an electrical desalting unit; atmospheric and vacuum distillation unit; Atlantic Catalytic Reforming Unit (Catformer) with a total charge of 3400 BSD; Socony Mobil Thermofor Catalytic Cracking Unit with a fresh feed charge of 6000 BSD; California Research Corporation Catalytic Polymerization Unit to produce 500 BSD of polymer gasoline; asphalt vacuum and oxidation unit to produce 1300 BSD of paving grade asphalt. There are also the necessary units for vapor recovery, solid copper chloride sweetening and double caustic and inhibitor treating.

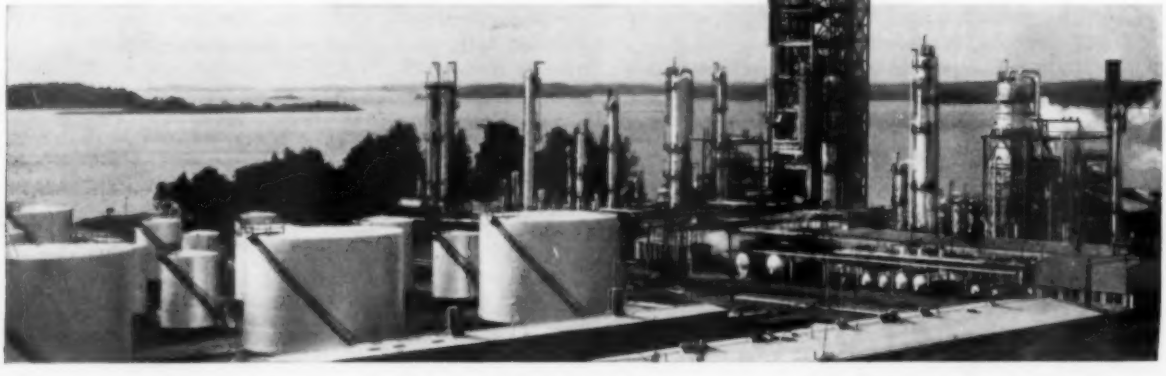
Under its contract with Neste Oy, Lummus provided detailed engineering, coordination of all procurement, construction supervision and extensive assistance during initial operation. Lummus also provided assistance in arranging for a broad financing scheme, set up an operator training school at the job site, and helped set up the overall refinery organization and manpower requirements.

Construction of the refinery was completed in July, 1957, with crude first introduced to the Atmospheric Unit by the end of July, 1957. The refinery was up to capacity, producing specification products within 6 weeks after start-up. Overall completion time was less than 24 months from the date when procurement areas were first definitely established.

One of the few refineries built thus far to have a fully electronic instrument control system, the new installation will meet about half of Finland's demand for petroleum products.

For design, engineering and construction of refineries anywhere in the world, Lummus' over fifty years of world-wide experience is at your disposal.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y., *Engineering and Sales Offices and Subsidiaries:* New York, Houston, Baton Rouge, Montreal, Caracas, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Washington, D. C. *Engineering Development Center:* Newark, New Jersey.



JOURNAL
REPORT

AIR POLLUTION CONTROL

TO FIND OUT just how refiners are approaching the problem of controlling their wastes, and what it's costing them, the Journal queried 40 companies. These companies' plants account for 83 per cent of the nation's capacity. This was the first such national survey ever undertaken, and the response was most gratifying—replies covered 77 per cent of refining capacity.

Compilation of data centered in the Journal's West Coast office at Los Angeles, under direction of District Editor **Dave Stormont.**

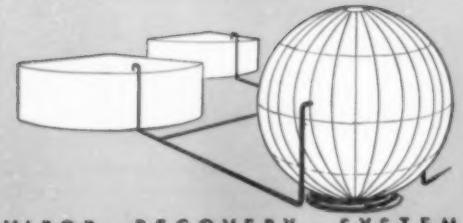
The study breaks down into four parts:

- **Cost of pollution control,** starting on the next page. Expenditures are broken out on an area basis as well as for class of pollutants being controlled.

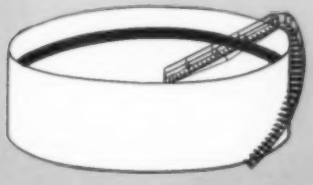
- **Organization for control,** pointing out how management must take a positive stand, and so inform all employes, if any abatement program is to be effective.

- **What researchers are doing:** The industry is spending over $1,000,000 annually to learn more about the chemistry of the atmosphere.

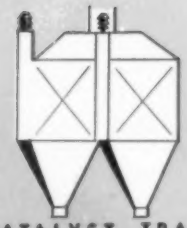
- **Trends in legislation.** More cities are adopting regulations in the face of mounting air-pollution problems.



VAPOR – RECOVERY SYSTEM



FLOATING–ROOF TANKS



CATALYST TRAPS

JOURNAL REPORT

Refiners spending millions in

It's not only good public relations, but it's

REFINERS not only are aware of the need for better air-pollution controls but are actively engaged in reducing the amounts contributed by their individual plants.

In the past 2 years these efforts have amounted to about a $46,000,000 expenditure. During 1958 an added $20,500,000 will be spent. In addition, the industry is spending about $1,000,000 annually for research.

These equipment expenditures were arrived at through a nationwide survey of refiners. Companies replying accounted for 77 per cent of the nation's refining capacity. Based on this information, total industry figures then were estimated.

Where spent . . . Refiners have been practicing air-pollution control in one form or another ever since the first plant was built. It's just good economics to keep valuable petroleum fractions confined to tanks and lines, and out of the air.

Many measures currently being taken throughout the industry go far beyond this basic step, however. In order to be a good neighbor, payout is weighed in conjunction with the value received by the public.

Need for air-pollution control depends to a great degree on the location of the refinery. Meteorological and topographical conditions in Los Angeles demand that refiners there adopt rigid control measures. From this extreme on one hand, need decreases as atmospheric conditions improve and population decreases. In Casper, Wyo., for example, many measures required in Los Angeles or Bayway, N. J., will never be necessary.

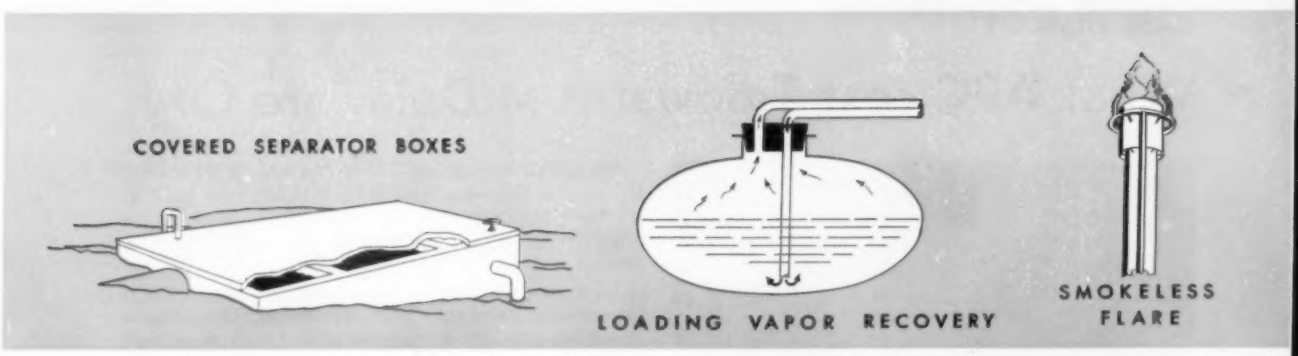
This is reflected in the survey data. As is shown in Table 1, East and West Coast refiners are spending several times as much as those in the midlands. On the Gulf Coast, where the flat terrain and good breezes prevent a buildup in pollutant levels, expenditures are less than on the other two coasts but almost twice as much as those in the Middle West.

Relatively little is being spent in the Rocky Mountain area. With its good meteorological conditions and wide-open spaces, the few refiners located in that region don't need extensive controls. For that reason this area is grouped with District 5, the West Coast.

Pollutants controlled . . . This difference in needs also is reflected in the types of pollutants being controlled

The Cost of Air-Pollution Control — TABLE 1

District (B or M)	Refining capacity 1,000 B/D	Capacity covered in survey, %	Expenditures reported in $1,000		Estimated total for U.S. in $1,000	
			1956-57	1958	1956-57	1958
1	1,589	86	$15,864	$ 3,613	$17,500	$ 4,000
2	2,645	69	2,943	2,808	4,100	3,800
3	3,578	77	5,953	3,111	7,400	3,900
4-5	1,711	83	14,758	7,669	17,000	8,800
Total:	9,523	77	$39,518	$17,201	$46,000	$20,500



fight against air pollution

sound economics not to waste valuable hydrocarbons

(Table 2). On the West Coast, little of the total expenditure is for controlling smoke and particulate matter. Refiners there went through this stage several years ago. Their interest is primarily in confining hydrocarbon vapors, either through recovery measures or combustion processes.

On the East Coast, hydrocarbon and sulfur-recovery measures account for more than three-fourths of the expenditures. In the other two areas, majority of the effort is devoted to control of sulfur compounds. Relatively little is being spent for hydrocarbon-recovery measures outside of the East and West Coast areas.

... **Controlling sulfur compounds** accounted for about one-third of the total expenditures reported by the 35 companies responding to the survey. The great portion of this was in connection with recovery plants built to serve new plants or new process units. They likewise account for most of the $5,303,000 scheduled to be spent this year.

For the total United States, approximately 1,600 tons of sulfur daily are being recovered, instead of being allowed to escape into the atmosphere as sulfur oxides.

In the Los Angeles area, where stack gases can't exceed 0.2 per cent of sulfur compounds (calculated as SO_2), more than 600 tons of potential sulfur oxides are being converted to elemental sulfur or sulfuric acid. One Gulf Coast company reported that during 1958 the amount of SO_2 discharged from its plant will be less than 5 per cent of the amount discharged in 1946.

In addition to facilities for removing H_2S from

35-Company Report of Amounts Spent for Controlling Various Pollutants

(Thousands of dollars)

TABLE 2

Pollutant controlled	District 1		District 2		District 3		District 4-5		TOTAL U.S.	
	1956-57	1958	1956-57	1958	1956-57	1958	1956-57	1958	1956-57	1958
Sulfur compounds	$5,787	$1,500	$ 373	$1,876	$2,400	$1,100	$3,748	$ 827	$12,308	$5,303
Hydrocarbons:										
A-combustion	3,058	343	601	337	630	300	5,665	3,590	9,954	4,570
B-recovery	4,759	378	367	175	1,055	846	4,442	2,831	10,623	4,230
Smoke & particulate matter	1,350	22	1,086	170	1,415	244	450	103	4,301	539
Odors and fumes	910	1,370	516	250	453	621	453	318	2,332	2,559

CASE HISTORY

What APC cost Tidewater at Delaware City

THE NEW 130,000-BBL. REFINERY of Tidewater Oil Co. at Delaware City is the largest ever built in a single step. It also represents the largest investment for air-pollution abatement ever laid out at one time.

Tidewater wanted to be a good neighbor when it moved into Delaware City. Accordingly, the stringent standards required for Los Angeles plants were used as a guide. Taking full advantage of what has been learned there about air pollution, measures to eliminate pollutants at the source were engineered into all process equipment.

... **The cost** was a whopping 7½ million dollars more than would have been spent if air pollution had been ignored. Official cost figures for the plant have not been released, but air-pollution abatement probably amounted to some 4 or 5 per cent of the total cost.

The accompanying table shows what the various control items cost. As will be noted, sulfur recovery and control accounted for about $4,000,000 of the total.

... **The payout** of the various items, Tidewater reported, will range from good to none. Because the plant is designed to handle high-sulfur crudes, a relatively good payout is expected from the sulfur recovery equipment. The same is expected from the waste-heat boiler and some of the hydrocarbon recovery equipment.

Poor or no payout will be realized from control gas streams, other steps being taken in many plants throughout the nation include:

1. Sour waste waters are steam-stripped before joining other plant waste waters. In most instances the stripped vapors then are burned in a high-temperature heater. In a few cases they are hydrogenated to H_2S and united with other streams fed to the sulfur-recovery plant. In the Los Angeles area at least a portion of the sour waste water is oxidized to avoid liberating SO_2 to the atmosphere when the gases are burned.

2. Burning of acid sludges has been discontinued at most large plants in populated areas. They are converted to ammonium sulfate, used for sulfuric acid manufacture, or disposed of in some way without releasing sulfur dioxide to the atmosphere. In most Los Angeles refineries and at some in other areas, the problem was solved by discontinuing use of acid treating for distillate products.

The expenditures shown for sulfur-recovery facilities reflect only what is being spent by refiners. They do not include costs of recovery plants built outside the refinery, and to which either the H_2S or rich amine absorption oil is piped.

In Los Angeles, the great bulk of the H_2S is converted to elementary sulfur in such outside chemical plants. Several of the East and Gulf Coast refiners reported they are taking the same route.

Combustion of hydrocarbons . . . Expenditures centering around maximum use of waste hydrocarbons for fuel amounted to $9,954,000 in 1956-57 and will total some $4,570,000 this year.

Largest item of these costs is for waste-heat boilers, installed in connection with cat cracking units or fluid cokers. A total of eight were reported added in the past 2 years and four will be installed in 1958. These vary in cost from around $400,000 to as much as $2,500,000.

These carbon monoxide or waste-heat boilers enter into air-pollution control through burning CO and hydrocarbons from the catalytic cracking regenerator or coking unit. Since the sensible heat contained in the gases and that from burning CO to CO_2 accounts for about two-thirds of the boiler's heat output, most companies reported a good payout was expected.

Other expenditures center largely around storage spheres and systems for gathering waste or off gases. By adding these facilities, less flaring results when capacity of gas burning equipment is exceeded. Costs of smokeless flares, where they were itemized separately by the companies, are grouped under the smoke and particulate matter control heading.

... **Hydrocarbon recovery measures** largely are confined to the East and West coasts. Costwise, most of the expenditures shown in Table 2 are for floating roofs on crude and product storage tanks. Where such is the case, the cost reported is in addition to that of a cone roof.

Another sizable item under this heading is in connection with cleaning up refinery waste waters.

measures costing some $1,100,000. Included in this category are the extra tall stacks for better smoke dissipation, the cyclones for the cat cracker and fluid coker, and the flare gas gathering system.

APC EQUIPMENT INSTALLED AT TIDEWATER'S DELAWARE CITY REFINERY

Item and why installed—	Add. cost over normal min.
Extra tall stacks—To dissipate stack gases completely	$230,000
Sulfur recovery—To recover max. sulfur	2,000,000
DEA absorption plant—To recover H_2S to feed sulfur recovery plant	1,560,000
Three-stage cyclones, cat cracker—To recover catalyst fines	100,000
Two-stage cyclones, coker—Keep coke fines in unit	100,000
Stack afterburner, coker — To eliminate coke fines, hydrocarbons, or CO from stack effluent	2,000,000
Foul water stripper—To remove sulfides and volatile hydrocarbons from waste process water	558,000
Phenol recovery, spent caustic recovery—To remove phenols from spent alkalies and strip organic acids from spent alkalies	200,000
Mechanical seals, all rotating pumps—Avoid oil losses to sewers	50,000
Closed relief valve system to flare—Avoid unburned effluents to atmosphere	250,000
Floating-roof tanks—Reduce evaporation of hydrocarbons	500,000
Total	$7,548,000

SOURCES OF AIR POLLUTION AND THEIR CONTROLS*

POLLUTANTS CONTROLLED			
Aerosols	**Gases**	**Control**	**Principle**
Dust Fume Smoke		Baghouses	Cloth bag filter (similar to vacuum cleaner type bag)
Dust		Cyclone	Centrifugal air separator
Dust Fume Smoke		Electrical precipitator	Electrostatic precipitation
Oil Mist	Solvent Malodors Aldehydes Ammonia Hydrogen sulfide	Fume burner	Afterburning
Dust Mist	Odor Organic acids Ammonia	Water scrubbers	Wetting and impinging
Smoke	Sulfur dioxide Oxides of nitrogen	Improved fuel, equipment or operation	Complete combustion
Smoke Fume	Sulfur dioxide Hydrogen sulfide	Sulfur recovery plant	Chemical conversion
Mist	Hydrocarbons	Vapor recovery systems; floating roof	Conservation

*Based on a similar table prepared by the Los Angeles Air Pollution Control District.

Open sumps are being replaced by API separators, either fully or partially enclosed. In either event the surface exposed to the atmosphere is reduced, resulting in lessened evaporation.

... Smoke and particulate matter control measures are being most widely undertaken on the East Coast. Effort made in the Middle West and Gulf Coast are not far behind, however.

Elimination of cat cracker plumes, through use of cyclones, afterburners, or better catalyst-circulating systems, account for the bulk of these expenditures. To reduce smoking during upsets, numerous smokeless flare systems have been installed.

Smoking stacks are being attacked in a number of ways. These include such measures as extra-tall stacks, to attain better dissipation; reduced use of fuel oil; and afterburners or "sky heaters," which incinerate hydrocarbons and other pollutants in the flue gases.

That much closer attention is paid to stack smoking was reflected in many replies. The amounts of money involved generally were not large. But such items as smoke indicators, recorders, oxygen analyzers, and other equipment to improve combustion—or to alert the operator that his burners needed adjustment—appeared on the replies from many companies outside the Los Angeles area.

Because of the importance it holds in smoke-control measures, a brief discussion on the Ringelmann chart is in order at this time (see section on trends in legislation for illustration and further discussion).

The Ringelmann system measures the degree of blackness of any smoke. Shades of gray between black and white are graduated in five equal steps. A smoke No. 1 density thus is comparable to a grid in which 20 per cent of the space consists of black lines. A No. 4 smoke would be equivalent to a grid in which black lines account for 80 per cent of the space.

The chart is widely used for determining whether emissions of smoke are within limits set by statutes or ordinances. Observations made by inspectors are accepted as evidence in courts.

... Odor control is being more widely practiced. More and more refiners are adopting the philosophy that refineries don't necessarily have to smell bad.

Most phases of air-pollution control, of course, could be classed as odor abatement. This would be particularly true insofar as some sulfur-recovery measures are concerned. In the breakdown of expenditures used here, however, odor control is largely confined to those measures where there is no payout.

Costwise, the amounts of money involved are not impressive. But as Los Angeles refiners have found out, a lot of odor control can be accomplished with very little capital expenditure. From the viewpoint of improved public relations, and the effect on employe pride and performance, they have found it is one of the best control measures a refiner can undertake.

This catch-all classification centers largely around steps taken to: (1) Control the release of mercaptans and hydrogen sulfide from refinery wastes, followed

Esso surveyed sources . . . then started to work

THE WORK BEING done by Esso Standard Oil Co. at its 175,000-bbl. Bayway, N. J., refinery offers a good example of what East Coast refiners are doing to reduce air pollution.

Through development and use of better controls—plus spending several million dollars—in the past 5 years the company has:

. . . **Cut combustion pollutants** by 80 per cent.

. . . **Lowered evaporation losses** by 50 per cent.

. . . **Reduced dust losses** from catalytic cracking units by 40 per cent.

Net result has been a 65 per cent reduction in aerial wastes. Further reductions will be made in evaporation losses during 1958.

In 1952 the company carried out an extensive survey to determine just what the plant's sources of pollution were. It was found that combustion operations accounted for 52 per cent of the potential. Evaporation losses amounted to 32 per cent. Those connected with fluid catalytic cracking were 16 per cent. Esso then started to work.

Combustion losses . . . Majority of the improvement shown in combustion losses resulted from sulfur-recovery measures. Acid sludges and hydrogen sulfide that would have been burned are now being converted to elemental sulfur in the neighboring chemical company.

Smoke emissions were reduced in three ways. Instead of using refinery generated steam and electricity, these are now obtained from a nearby power plant. By making maximum use of instruments, closer control over furnaces in process service was obtained. Less emergency flaring was the third step.

. . . **No flaring** is the goal sought. That it has almost been reached is shown by the accompanying chart. It is being achieved through an intensive effort to eliminate the need for emergency flaring. Methods for accomplishing it have been closer control over plant operations and by providing spare processing capacity where its use would reduce the need for flaring.

Latest effort has been to eliminate small quantities of vapors flared from leaks in process equipment, from sources such as safety valves or gas coolers. Because of the small quantities involved, they are difficult to find. The units are shut down when the leaks become excessive, but short of that it's not always easy to find them.

So that such leaks can be easier spotted, Esso is installing new hot-wire anemometers in laterals leading to smokeless flares. Called an Anemostat, this instrument is capable of measuring very small gas flows. Some $15,000 has already been spent for these devices and an additional $35,000 will be spent in 1958. This effort is expected to further cut flaring losses to about 50 bbl. daily, only 15 per cent of what they were in 1952.

Evaporation losses . . . As shown in an accompanying chart, steady progress also has been made in reducing evaporation losses. A portion of the 50 per cent decrease was due to an extensive program of replacing cone roofs with floating roofs.

In the past 2 years, $132,000 was spent for floating roofs to replace good cone roofs on gasoline tanks. In replacing wornout decks on crude and naphtha

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by the pollutants being burned in high-temperature furnaces or, as is the case in some Los Angeles plants, by oxidation to avoid the release of sulfur oxides; (2) incineration of air used in oxidizing processes; (3) better policing of sewers; (4) elimination of open pits and basins which have become oil-soaked from years of use; and (5) use of odor counteractants or masking agents.

From the cost viewpoint, one of the more important activities centers around better handling of spent caustic solutions. Several companies reported they were installing new regeneration facilities or taking other steps to eliminate the old practice of dumping. Oxidation to sodium thiosulfate is the most common method of handling the problem.

In some plants the spent solutions are used for neutralizing low-pH waste waters. At others, the spent solutions are sold to outside chemical companies, who recover such compounds as phenols and cresylic acid.

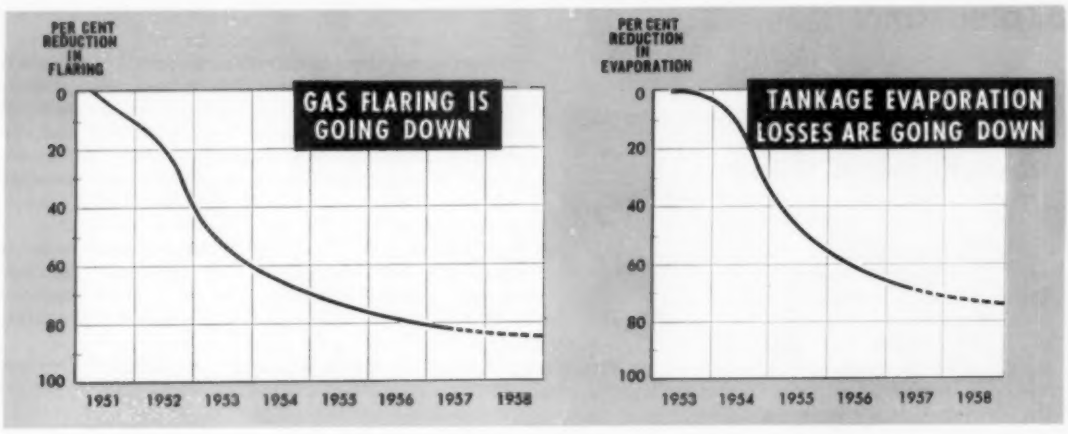
Closer supervision of what wastes are allowed to enter the refinery sewer systems was mentioned by a number of companies as one means of reducing odors. Spent catalysts, scales, spent caustic soda, and other materials containing hydrogen sulfide are kept out. By maintaining conditions within the refinery as steady as possible, amount of oil entering the sewers is held to a minimum.

Case histories . . . Differences in needs of refineries, from the viewpoint of both geographical location and process equipment, do not permit discussion of an "average" or "typical" pollution-control program. To give a good idea of the extent of the activity, however, highlights of those undertaken at two East Coast plants are discussed elsewhere on these pages. Efforts of Los Angeles refiners also are summarized in another case history.

That of Tidewater Oil Co. at its 130,000-bbl. Delaware City refinery is of particular interest. It reflects the extensive expenditure necessary for a new large refinery. Esso Standard Oil Co.'s program at its Bayway, N. J., refinery illustrates the type of control measures being undertaken at older East Coast plants.

As will be noted, measures being undertaken by Los Angeles refiners and those by Esso Standard are quite different. Those in Los Angeles largely center around hydrocarbons. Esso's includes smoke and dust control, hydrocarbon evaporation, and other steps which Los Angeles refiners had taken several years earlier.

Relative payouts . . . As is reflected in Table 3, some of the control measures have good payouts. In these cases, and in most of those where a fair return was anticipated, the payout could be traced to more efficient



tanks with floating roofs, $470,000 more was spent than would have been if cone replacements were used. Over-all evaporation losses from tankage have been cut 70 per cent.

Closer attention to what goes into the plant's sewer system, improved oil skimming, and other such activities also have acted to reduce hydrocarbon losses. These will be further reduced this year when a $700,000 incinerator is completed. It will efficiently consume materials formerly burned in open fires, and are now being buried.

Catalyst dust . . . Through careful control of operating equipment and use of cyclones, only 0.005 per cent of the 60 tons per minute of catalyst circulated in the fluid catalytic cracking plants is lost to the air. Stronger catalysts also are being used to reduce attrition loss.

Esso's improved pollution control did not come about solely from use of improved equipment and control devices. Much effort also has been devoted to making employes more air-pollution conscious.

The company not only is doing something about pollution abatement, but it's talking about it too. Last July, state, county, and city health and pollution-control officials were invited to visit Bayway and see what had been accomplished.

How the industry as a whole profited from Esso's speaking out is apparent from the following quote which appeared in an editorial of the Newark Evening News a few days later:

"Industry generally has not been conspicuously cooperative in antipollution efforts. It is to be hoped that Esso's example may be an inspiration. Compulsion is the inevitable, and probably the more expensive, alternative."

operations. Most smaller expenditures fell into the poor or no-payout category.

Steps taken in connection with the recovery of sulfur compounds were reported to have the best return of the five categories. About 65 per cent of these expenditures were expected to have a "good" return, some 10 per cent had a "fair," and 25 per cent had a "poor" or no payout.

This has not been the experience of Los Angeles refiners, however. There it was mandatory that the plants be installed. They could not be selective.

In general, the Los Angeles facilities thus have not operated at a profit. Operating losses in 1955 were reported to range from a breakeven, before capital amortization, to an annual loss of $150,000. This covered only the plants operated by the refiner, not those where the sulfur was produced by an outside chemical company.

35-Company Report of Relative Payout of Control Equipment — Table 3

PERCENTAGE OF EXPENDITURES WHICH WERE:

Pollutant controlled	GOOD		FAIR		POOR	
	1956-57	1958	1956-57	1958	1956-57	1958
Sulfur compounds	64	69	14	5	22	26
Hydrocarbons:						
A—Combustion	47	13	23	70	30	17
B—Recovery	42	27	26	36	32	37
Smoke and particulate matter	38	6	14	11	48	83
Odors and fumes	5	4	34	7	61	89

CASE HISTORY

What Los Angeles refiners have done

BECAUSE of the unusual smog conditions which prevail in Los Angeles, refiners there have gone much further toward eliminating air pollution.

Since serious work was started about 10 years ago, they have spent approximately $6,000,000 for research and $33,000,000 for air-pollution control. Most of the latter was to comply with new or planned ordinances. However, they have gone far beyond legal requirements in an effort to operate "unseen, unheard, and unsmelled" refineries.

With the advent of the smog problem, initial efforts were directed toward controlling emissions of sulfur dioxide. Since about 1953, bulk of the effort has been for controlling hydrocarbon vapors.

Insofar as sulfur compounds are concerned, about 600 tons of sulfur dioxide are being recovered daily as sulfuric acid and elemental sulfur. Adding these facilities involved an expenditure of about $8,000,000. For the most part they do not operate at a profit.

How much hydrocarbon losses have been reduced can only be estimated. The Los Angeles Air Pollution Control District places current losses at about 105 tons daily, as compared with 830 tons in 1951. Oil-industry studies more or less check with today's losses, but not with the amount of reduction. A March 1953 survey of the Western Oil & Gas Association showed that losses from plants representing 91 per cent of the area's refining capacity totaled about 250 tons daily.

. . . **Hydrocarbon vapor losses** have been cut by: (1) controlling evaporation losses at storage tanks, (2) reducing evaporation losses from separators and sewers, (3) installing recovery equipment at truck-loading racks, and (4) numerous other measures such as equipping centrifugal pumps with mechanical seals and installing flare systems with smokeless burners.

Reducing tank-evaporation losses has been an expensive undertaking. More than $6,000,000 has been spent to provide floating roofs, vapor-recovery, and vapor-balance equipment on light-product tanks greater than 1,000-bbl. capacity.

Most of the expenditure was economically unattractive. Installation of facilities which cost $5,050,000 resulted in an estimated gasoline recovery of only 530 bbl. daily.

Controlling hydrocarbon losses from skimming ponds, separators, sumps, and sewers has cost refiners well over $1,000,000. Little was accomplished when viewed from the point that automobile exhausts spout some 1,200 tons of hydrocarbons daily into the air. Uncontrolled, these refinery sources were estimated to have contributed only 40 tons daily. Today they are less than one-fourth this amount.

Measures to reduce losses of hydrocarbons during truck-loading activities at refineries and large bulk terminals have cost $3,000,000. These steps consisted of installing vapor-recovery facilities at 27 racks which have gasoline-loading capacities in excess of 20,000 gal. daily. Recovered vapors are either burned as fuel gas or reabsorbed in the gasoline. For the 20 larger racks, the volume of vapors recovered ranges from 0.066 to 0.2 per cent of the total gallonage handled daily.

Of the expenditures for sulfur-recovery equipment covered in this survey, most went for new plants of large capacity. Thus it might be expected they would show a good return. Where the cost was to tie in a new process unit or modify existing equipment, the planned payout was not so good. Where it involved stripping hydrogen sulfide and mercaptans from waste waters, no payout was expected.

. . . **Hydrocarbon-control** measures were next highest in payout. Where combustion was involved, most of the expenditures were for waste-heat boilers. In most cases the company reported a good payout was expected. Off-gas burning equipment and other such control steps were usually reported as having a poor payout or none.

Equipping light-product storage tanks with floating roofs accounted for most of the money spent for hydrocarbon recovery. Payout expected mostly was in the good or fair classification. The high percentage of expenditures from which little or no payout is expected largely is connected with the Los Angeles requirement that large truck-loading racks be equipped with vapor-recovery devices (see Los Angeles case history).

As is shown in the table, bulk of the expenditures for controlling smoke and particulate matter will have little or no payout. Those for odors and fumes are even less attractive.

. . . **Air-pollution surveys** have become routine practice at most of the nation's larger refineries. Reflecting the growing awareness of the problem, about 75 per cent of the reporting companies replied they are holding periodic audits. In several instances, outside research organizations are employed to carry out the work.

Typical surveys include determinations of sulfur dioxide, sulfur trioxide, dust, and hydrocarbon content of the atmosphere. Composition of the stack effluents are analyzed. In some cases the concentration of sulfur dioxide at ground level is determined by continuous recording meters at various directions and distances from the refinery.

"Some of the control methods have good payouts. In these cases, and in most of those where a fair return was anticipated, the payout could be traced to more efficient operations. Most smaller expenditures fell into the poor or no-payout category."

The foregoing account for only about half of the sums spent. The balance went for numerous other recovery measures, including flare-gas systems, leakage control, elimination of catalyst dust, smoke and plume elimination, and odor abatement. Harmless steam plumes have been done away with in some cases, because they attract attention. Even cooling towers have been designed with excess capacity in order to cut down on their plumes.

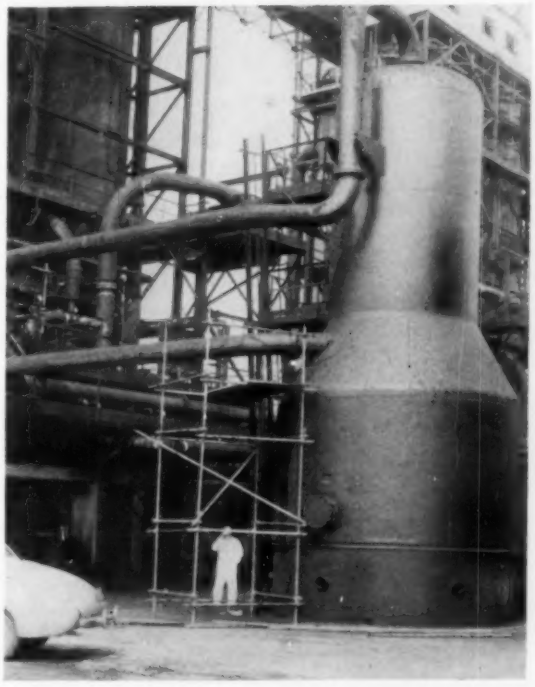
Steam plume control . . . Extent to which these activities have been carried out can probably best be illustrated by a remedial measure recently completed at General Petroleum Corp.'s Torrance refinery.

General Petroleum operates the only delayed coker in the area. When the coker was blown down three times daily, huge steam clouds blossomed into the sky. They had a slightly antiseptic odor, but did not present a pollution problem. The vapors met all requirements of APCD, and had received a clean bill of health from that agency.

But Los Angeles citizens might believe the steam clouds were contributing to the smog problem. So the company spent almost $500,000 to eliminate them. There will be no payout, other than possibly improved public relations.

In the new blowdown system, developed after a year's research, the exhaust first goes to a knockout drum. Enroute, and in the drum, oil vapor and entrained tars are removed by contact with a gas-oil stream circulated from the partially filled drum.

Overhead from the drum is steam, light oil vapors, and noncondensables. Using air-cooled condensers, the water and oil fractions are liquefied and run to an accumulator. Noncondensables pass to the flare-gas gathering system and are burned in a smokeless flare. Operation of the entire blowdown cycle is automatically controlled.



KNOCKOUT DRUMS for General Petroleum Corp.'s new coker blowdown system. Exhaust first goes to this drum. En route, and in the drum oil vapor and entrained tars are removed by contact with a gas-oil stream circulated from the partially filled drum.

Control starts at the top

. . . and organization extends from top to bottom

CONTROL OF AIR POLLUTION not only requires good, modern equipment but also a staff of well-trained employes who have been thoroughly schooled in the need.

Unless everyone in a refinery, from the manager or superintendent to the unit operator, has a full understanding of the problem, control can't be effective no matter how much instrumentation and modern equipment are installed.

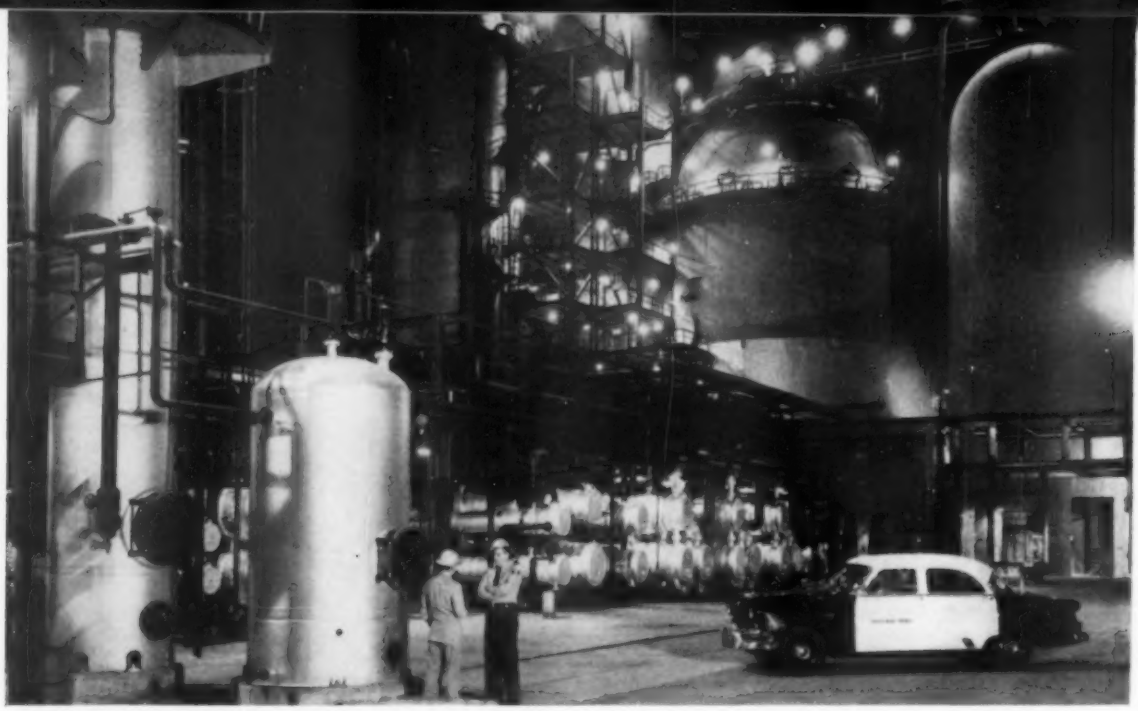
Control thus begins with top management. It must provide the funds; be willing to invest in additional control measures if the local situation shows they are needed. It should not tell plant managers how local problems are to be solved, however.

Of equal importance, top management must be thoroughly interested in pollution prevention. If so, it will see that comprehensive antipollution directives are made a part of company policy—and that they are carried out to the letter. It must see that abatement becomes such a generally accepted part of company thinking that even the newest unit operator will be air-pollution conscious in his work.

Some "pressure drop" is inevitable as any philosophy descends the levels of management. But with proper organization and constant effort, all employes will become aware that top management is sincerely interested in eliminating air pollution.

Pollution policies set by three companies are shown elsewhere on these pages. They reflect the sincerity with which the industry is attacking the problem. Those shown are typical of the policies set by most companies.

Responsibility for control . . . In the replies to the questionnaire, almost without exception the refinery manager or superintendent was named as the person re-



AIR POLLUTION PATROLS operate day and night in Los Angeles. Here an inspector checks on operations in one refinery after midnight.

sponsible for controlling air pollution. He receives technical assistance from other divisions, such an engineering or research. But responsibility for minimizing air pollution rests with the local refinery head.

How the manager passes this responsibility down does not vary too much from company to company. In most cases, the Journal's survey showed, air-pollution control is assigned to the same group which polices waste waters. The number of people engaged solely with air pollution is determined by how critical the problem is at the individual plant.

Duties of this pollution abatement group generally include the following:

1. To keep management informed of control regulations, policies, and conditions of the plant.
2. Maintain surveillance of plant equipment and initiate action to correct any air-pollution problems encountered.
3. Work with foremen and operators in educating all personnel to be air-pollution conscious in their jobs.
4. Handle contacts with regulatory officials.
5. Inaugurate surveys when needed.
6. Attend meetings concerning air pollution.
7. Handle complaints from nearby residents.

Extent of this group's duties, of course, depends on the local situation. In a critical location, such as Los Angeles, any one of the above can be an extensive activity.

For this reason, all Los Angeles plants have a technical man—usually an able engineer long on tact and diplomacy—engaged full time in air-pollution control. He reports "high up" on the plant organization chart, usually to the manager or assistant manager.

Personal participation necessary . . . Through the activities of this antipollution group, refinery management is able to keep abreast of the problem. The program can be much more effective, however, when the plant manager takes a strong personal interest. This can be done in a variety of ways, such as:

1. Seeing that air-pollution control is on the agenda at every staff meeting.
2. Personally inspecting the plant regularly, looking for odors, leaks, and other sources of contaminants.
3. Conducting a regular "audit" on practices and procedures.

Socony Mobil's creed

Socony Mobil is a responsible corporate citizen of each community in which it operates. We will never abuse the privilege of citizenship. Public concern over air and stream pollution is growing. Our plants will strive to do a better job than public regulations require. Merely to stay within the limits set by law, or to make a better record than our industrial neighbors, is not enough. Our goal is to eliminate air and water pollution from our plants as sources of annoyance and discomfort to the surrounding community.

1. Management will see that employes at all levels throughout our organization understand our policy.
2. Employes will be encouraged to tell their families and friends about our policies, so that the community will know what we are doing.
3. Management will work actively with community and industry groups studying pollution problems. When pollution control laws are proposed in a community, our people should, as responsible citizens, assist to insure that any action taken is sound and realistic.
4. Management will continually review existing and proposed plans to insure against preventable pollution.

4. Displaying posters on bulletin boards, and including news of air pollution in bulletins to supervisory personnel.

5. Requiring that every unit operator sends a report directly to the manager's office each time there is excessive smoking, pluming, etc. The report will explain why it happened.

6. Solicit employes' ideas on control methods and practices. This alone will lead them into being more air-pollution conscious.

Handling complaints . . . In general, refiners are thoroughly convinced of the need for prompt attention when a complaint is received from a nearby resident. This is best illustrated by some replies to the Journal's questionnaire.

"Air pollution is considered to be a public-relations problem. In the case of any complaints, we make every effort to determine the sources of complaints. If we are responsible for the complaint, we immediately alleviate the condition. We have found it most important to handle complaints promptly; to see that the complainant is fully informed of circumstances that may have led to this complaint, and the steps that our company is taking to remove the source of the complaint."—**Socony Mobil Oil Co., Inc.**

"All complaints are immediately investigated by a refinery representative. If the refinery is found to be the producer of the nuisance, the source is located and corrective steps are taken as soon as possible.

"A refinery representative contacts the complainant personally, explains the cause, and assures the person that the nuisance has been eliminated or will be as soon as possible. If the refinery is not responsible for the complaint, the complainant is convinced of this fact. The representative expresses the company's appreciation for being notified, and impresses the complainant with the company's desire to be a good neighbor."—**A Gulf Coast refiner.**

As Standard of Ohio sees it

It is our policy to dispose of our air-borne and water-borne wastes in a manner which will: (1) not adversely affect the health, safety or property of our employes and neighbors; (2) create unreasonable or unnecessary pollution problems in the surrounding community; or (3) interfere with the reasonable and necessary use of public waters.

The installation and operation of such waste reduction facilities and the control of waste quality, consistent with this policy, shall be considered a necessary cost of doing business. Standard Oil Co. of Ohio recognizes responsibility in this field to:

1. Sohio employes;
2. Our neighbors, customers, and the general public;
3. Local, state and federal regulatory bodies;
4. Sohio stockholders.

We will take affirmative action consistent with this policy to maintain our leadership in this field. As significant advances are made in our waste-control efforts, we shall explain what has been accomplished to Sohio employes, the press, and the interested public.

Where appropriate, the following actions shall be taken in implementing the above policy:

1. The aim of waste-control work should be to carry out necessary steps to insure good public relations in the communities in which we operate, while simultaneously meeting the requirements of various regulatory groups.
2. Studies shall be conducted to evaluate the need for waste control measures.
3. Research and development work shall be conducted when required to devise new or improved waste treatment methods to solve special problems.
4. Investigations should not overlook the possibility of recovering valuable by-product materials, while simultaneously treating waste products satisfactorily, at a reasonable cost.
5. We should cooperate openly and fully with all qualified groups concerned with waste control.

. . . Standard of California, Western Operations

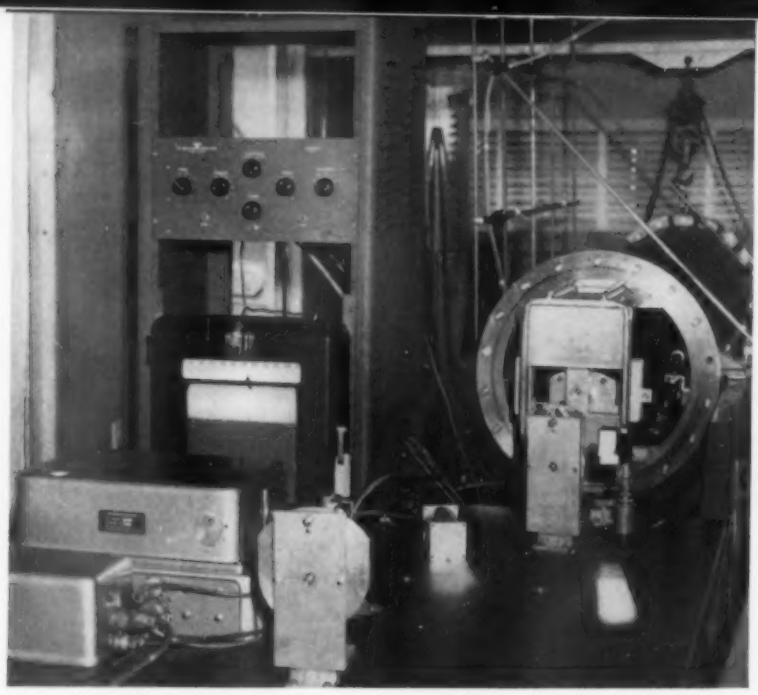
It is the company policy to cooperate with governmental agencies in the control of air pollution and pollution of public waters. It is the intent of the company to be a good neighbor in areas where it has operations and to regulate the discharge of substances into the atmosphere and public waters which will promote the highest economic use of the receiving body of water or of the atmosphere. Pursuing this policy may lead, in some cases, to the installation of equipment to control pollution which exceeds requirements covered by state laws or local ordinances.

The laboratory division is responsible for the frequency and adequacy of all sampling and testing to determine compliance with applicable laws and regulations, and shall notify management immediately of any unsatisfactory condition encountered.

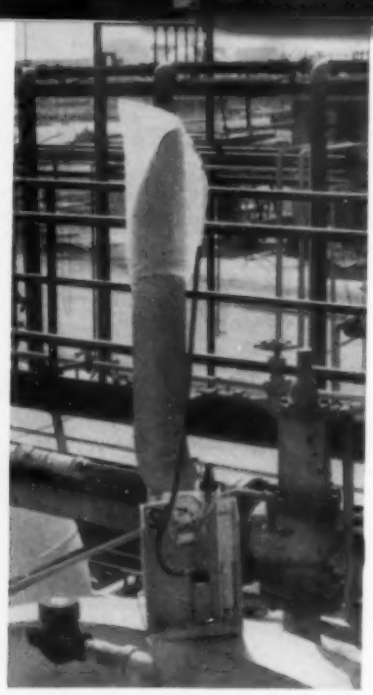
The refinery general manager is responsible for any pollution of the atmosphere or public waters resulting from the operation or failure of any equipment over which he has jurisdiction and for the initiation of such corrective measures as may be necessary. The refinery general manager is expected to be familiar with, and kept informed of, laws and regulations affecting the pollution of the atmosphere and public waters.

The engineering division is responsible for the design of adequate facilities for the control of pollution of the atmosphere and public waters; for recommending to the refinery general manager what steps should be taken to provide new, or alter existing, facilities to accomplish effective control of pollution; and to furnish instructions for the safe and proper operation of control equipment.

The engineering division is responsible for the study of possible sources of pollution; steps to be taken to prevent pollution; and for the execution of such measures as the refinery general manager may direct.



TRAILER-MOUNTED long-path cell and equipment being used by Franklin Institute for infrared analysis of irradiated mixtures of hydrocarbons and nitrogen compounds. This work has shed much light on how smog is formed.



DIRECT-TEST METHOD for measuring leak rate from relief valves. A polyethylene shroud covers horn inlet, and a dry-gas meter measures volume of gas escaping.

We're learning about air chemistry

Research is filling in gaps in our knowledge

IN ADDITION to the millions of dollars it's spending to check air pollution, the petroleum industry is investing over $1,000,000 annually for basic research.

Objectives of these investigations are to establish the exact reasons for the mechanism of air pollution . . . a field in which almost nothing was known less than 10 years ago.

Once the fundamentals are learned, the industry will be in a much better position to advise air-pollution-control authorities. It can point out that certain proposed legislation is restrictive and unnecessary. If legal curbs are necessary, need can be substantiated by fundamental knowledge rather than theory or guesswork.

The need for greater knowledge on the chemistry of the atmosphere can best be illustrated by what happened to Los Angeles refiners. When smog began to plague the area in the late '40's the public and its officials singled out the refineries as the cause. Specifically, oxides of sulfur were said to be the culprit.

The industry had no information to the contrary, so some $7,500,000 was spent for sulfur-recovery plants. This corrected a pollution condition, but the smog problem became worse instead of better. For, as is now known, sulfur compounds do not contribute to the eye-burning, plant-damaging properties which make Los Angeles' smog so objectionable.

It was only through intensive studies that the real culprits—hydrocarbons, oxides of nitrogen, and sunlight—were singled out.

Realizing that more basic information was needed on the composition of the air outside the refinery gates, in November 1951 the API Division of Refining formed the Smoke and Fumes Committee. This organization is now the industry's primary research tool. A similar committee of the Western Oil & Gas Association, which contributed so much to early studies on smog, is continuing its investigations on the nature and origin of air pollution in southern California.

Research projects . . . Studies sponsored by the Smoke and Fumes Committee are concerned primarily with fundamental research to determine causes of air pollution. After the completion of six projects, five currently are on the active list. These are:

1. Reactions of hydrocarbons.
2. Sources of gaseous carbon materials.
3. Plant damage caused by air pollution.
4. Effects of meterological conditions.
5. Gas chromatographic methods of analysis of automobile exhaust gases.

The projects are being carried on under contract at various established research centers, at an annual cost of about $250,000. Highlights of these projects are:

. . . Reactions of hydrocarbons and nitrogen compounds in sunlight are being studied by Franklin Institute in Philadelphia and in South Pasadena, Calif. Using a long-path infrared spectrometer, dubbed

AIR-POLLUTION CONTROL

"Silent Sam," scientists can detect products in extremely low concentrations (see photo).

These studies have borne out earlier laboratory studies as to compounds and reactions involved in the formation of smog. By irradiating mixtures of hydrocarbons and nitrogen dioxide (or nitric acid) in the 100-meter cell, new organic nitrogen compounds are found which are also present in smog. The presence of ozone, long used as the primary smog indicator, also was confirmed.

This work has proved conclusively that a typical paraffinic hydrocarbon will react with nitrogen dioxide in the presence of oxygen to form ozone. It also has been found that olefins react more rapidly to form ozone than do paraffins. Formerly, ozone had been identified only by indirect means.

Studies in the infrared spectra recently led to the identification of an entirely new compound. Originally it was referred to as "Compound X," Now it's tentatively identified as peroxyacyl nitrite.

Researchers hoped the new compound would prove to be the culprit responsible for eye irritation and crop damage. But such was not the case. It appears that peroxyacyl nitrite is an intermediate compound in the smog reaction.

. . . **Sources of gaseous carbon materials** is the subject of a study started in 1957 at Truesdall Laboratories in Los Angeles. This project involves studies of carbon monoxide and carbon dioxide samples to determine their origin; whether or not they came from petroleum or from such live fuels as paper or wood. Technique used is that of radioactive carbon dating.

. . . **Plant damage** caused by air pollution is being studied by University of California at Riverside. This work consists principally of studying the reactions of organic materials and oxides of nitrogen in ozone, and in determining effects of the products on plant life.

It has shown that crop-damaging substances result from the reaction of ozone and an olefin. The final products of this reaction, however, do not cause the damage attributed to smog. It is due either to an intermediate, or to a reaction product which forms on the plant under conditions unlike those in the atmosphere.

. . . **Effects of meteorological conditions** on sampling techniques are being investigated by North American Weather Consultants at Goleta, Calif. These studies involve the effect of such things as weather, rain, and topography on the path taken by a pollutant from a single source.

This project is an outgrowth of a "tracing emissions" study carried out by Industrial Hygiene Foundation at Mellon Institute in Pittsburgh. Objective of this project, which was completed in June 1956, was to devise a tracer method which avoids disadvantages of the well-known fluorescent powder technique.

Finely divided antimony oxide powder dispersed into the stack gas stream at a uniform rate gave good results on a field test. It provided the same high sensitivity that would be attainable with a radioactive tracer. But the hazard was eliminated since the samples were made radioactive only after the tests had been completed.

. . . **Exhaust gases from automobiles** are being analyzed by gas chromatographic methods at the Bureau of Mines station in Bartlesville, Okla. This work (jointly sponsored with the Coordinating Research Council) is particularly concerned with smog; refineries are not directly involved. But they may be in the future.

Evidence of smog has been found in San Francisco and Philadelphia. The problem undoubtedly will become more prevalent as these and other industrial communities become more densely populated.

The automobile not only is the largest single source of hydrocarbons, but also is the principal contributor of nitrogen oxides. It is estimated that 1,100 tons of nitrogen oxides daily are discharged in the Los Angeles air, of which as much as 70 per cent may be from automobiles. Thus the industry is concerned in this effort to evaluate motor vehicle exhausts.

. . . **Other studies** in which the Smoke and Fumes Committee is participating include a cooperative program with the Air Pollution Foundation. The committee is sponsoring work by Franklin Institute on studies of auto exhausts and the foundation is sponsoring similar work by Stanford Research Institute. Both projects are being carried out at South Pasadena.

. . . **Studies completed** by the committee, but not discussed above, include:

1. Development of a method of detection of ozone suitable for use in continuous, portable instruments.
2. Evidence that furnaces burning petroleum fuels do not release significant quantities of hydrocarbons to the atmosphere.
3. Scientific proof that the oxidation of sulfur dioxide to sulfur trioxide in the atmosphere is too limited to produce a significant reduction in visibility.
4. An analysis of the air in several U.S. cities, showing absence of the abnormal ozone or oxidant content found in Los Angeles' smog.

Joint refinery survey . . . A project will shed much light on losses of Los Angeles refineries was scheduled to be completed at the end of 1957. Because further data were wanted, the survey probably will not be concluded until mid-1958.

This huge undertaking involves agencies of the county, state, and federal governments and the Western Oil and Gas Association. Of the several possible sources, six were selected for study in the opening phase. These were: Catalytic cracking unit plumes, cooling towers, pumps, valves and flanges, storage tanks, and air blowing.

Studies completed to date tend to verify earlier findings that Los Angeles refineries are a very minor source of hydrocarbons—about 105 tons daily. This compares with the estimated 1,200 tons daily from the automobile, some 500 tons from solvents used in painting, dry cleaning, etc., and 115 tons from incinerators.

The 105-ton figure for refineries is solely an estimate. Purpose of the joint project is to obtain more

precise data. It is sufficiently comprehensive to insure that results are statistically valid. Where it is impossible to take test data, loss estimates are based on the best possible methods of calculation after thorough studies of the equipment and operation have been made.

...Leakage from relief valves is one study completed. In seven major plants, which account for 90 per cent of the refining capacity in the area, there were found to be 1,100 relief valves on operational units and 350 on pressure-storage vessels. Field tests were made on 460 valves (an accompanying photo shows the test equipment used in one type of test).

Leakage from relief valves was found to total about 2 tons of hydrocarbons daily. Those on operational units accounted for about 75 per cent of the loss. They had a slightly lower leak incidence, but a much higher average leak rate than did those on pressure storage vessels.

...Leaky valves were found to be contributing about 13 tons of hydrocarbons daily, of which 7.5 tons were in a gaseous state. Majority of the 5.5 tons of liquids were recovered and returned to the process, it was found.

In this survey nearly 10,000 valves were inspected, out of an estimated 132,000 in Los Angeles area refineries. Using the test equipment shown in an accompanying photo, about one out of every six leaks discovered then were measured.

Flanges also were included in this survey. They were found to have only about one-tenth the leak frequency of valves; only four leaks were found in the 326 tests.

...Cat cracker regenerators also were the subject of intensive studies. Six fluid and nine Thermofor catalytic cracking units are operating in Los Angeles refineries. Their total charging capacity is about 300,000 bbl. daily.

All Thermofor units are equipped with cyclone collectors. Fluid units have cyclones installed ahead of electrostatic precipitators. In one instance the regenerator gases are passed through a CO waste-heat boiler enroute from the cyclones to the precipitator.

Contaminants coming from regenerator stacks of these 15 units are shown in the accompanying table. These losses are not to be considered as absolute values, the joint committee emphasized in its report. Operating conditions vary from time to time, and these affect the quantity and character of the materials emitted. The data do show the range of emissions, however; something not known before the survey was made.

Catalyst-dust losses apparently are almost nothing, probably in the range of 0.002 per cent or less. The 15 units are circulating catalyst at about a 13,600-ton per hour rate. Using the low loss figure of 0.002 per cent thus would result in a particulate matter total of only 6.5 tons per day.

As shown in the table, hydrocarbon losses were found to total 20 tons. This figure will be even further reduced when two planned waste-heat boilers are placed in operation.

EMISSIONS FROM CATALYTIC CRACKER REGENERATOR STACKS

Substance*—	Rate, tons per day
Particulate matter	5.4
Sulfur dioxide	43.3
Sulfur trioxide	2.7
Ammonia	4.4
Aldehydes (as HCHO)	1.9
Oxides of nitrogen (as NO_2)	5.2
Hydrocarbons	20.0

*Except for hydrocarbons, the emissions were determined by physical and chemical analysis. Hydrocarbons (as hexane) were determined by mass spectrometric analysis.

Emissions of sulfur compounds were found to consist of 43.3 tons of sulfur dioxide and 2.7 tons of sulfur trioxide. APCD regulations specify that a single source to the atmosphere must not contain concentrations of sulfur compounds in excess of 0.2 per cent by volume (calculated as SO_2). With but one exception, the cat regenerator stacks were well below this limit. All but two had concentrations of less than 0.1 per cent.

...Other completed studies include those dealing with hydrocarbon emissions from cooling towers and tankage. Those from cooling towers, as might be expected, were found to be of little consequence. Of the 93 operating in Los Angeles refineries, 17 were found to be losing a total of 3 tons daily.

Hydrocarbon losses from storage tanks in Los Angeles refineries were calculated to total 42 tons daily. Of this amount, 27 tons were from light-distillate tanks with a total capacity of 20,807,000 bbl. Crude-storage tanks, with a capacity of 7,383,000 bbl., were found to be contributing 15 tons daily.

This tankage survey was made more than 2 years ago. Today's losses are much lower because of the large amount of remedial work which has since been carried out.

When the entire project is completed later this year, it may be that hydrocarbon losses will be found to be higher, or lower, than has been previously estimated. But in any event, Los Angeles refineries will know what their losses are and where they are coming from. They thus will be in a much better position in their dealings with APCD officials.

Acknowledgment... The author expresses appreciation to the 35 oil companies which supplied data on their air-pollution-control activities. Without this cooperation the survey would not have been possible. Appreciation also is expressed to the publications committee of the API Smoke and Fumes Committee for reviewing this material prior to publication.

...Photo credit: The photos of Tidewater Oil Co.'s new refinery shown on page 90 was supplied by C. F. Braun & Co., engineers and constructors of the plant. Those on pages 96 and 101 relating to the joint survey in Los Angeles were furnished by the Air Pollution Control District. Other photos shown were supplied by the oil company named in the caption.

WITH LEGISLATION ON THE INCREASE, health authorities and government officials are becoming familiar figures in refineries. Here D. P. Victorian, left, discusses control steps at Esso Standard Oil Co.'s Bayway, N. J., refinery with air-pollution officials during an open house.

How lawmakers view the problem

Regulations mount steadily but refiners are acting voluntarily to do what they can to combat air pollution

AS IT DID years ago in the disposal of refinery waste waters, the day has come when refinery smokes and vapors no longer can indiscriminately be discharged into the atmosphere.

Federal, state, and local regulations against air pollution are mounting steadily. In crowded urban areas these controls are regarded as necessary as those for traffic, noise, or construction activities. It is one of the most serious problems facing large cities today. In many of these are large concentrations of refining capacity.

Thus from the legal aspect alone, refiners should recognize air pollution whenever it exists and take steps toward abatement. And this they have been doing. Common practice is for refiners to move as rapidly and practically as they can toward abatement whenever a pollution problem arises. Their efforts have almost entirely been voluntary rather than compulsory.

Such a realistic, positive policy has a dual effect. It not only will keep them out of the courts, but also will make friends for the industry. This good will could be the determining factor in securing favorable legislation on issues necessary to the industry's continued good health. It likewise could be advantageous in any one of a thousand other minor incidents which crop up weekly.

Los Angeles controls . . . Much of the industry's basic knowledge of air pollution control methods has been gained in the Los Angeles area. Lawmakers likewise look to this region as the source for rules to control pollution. For this reason a brief review of the Los Angeles situation is in order.

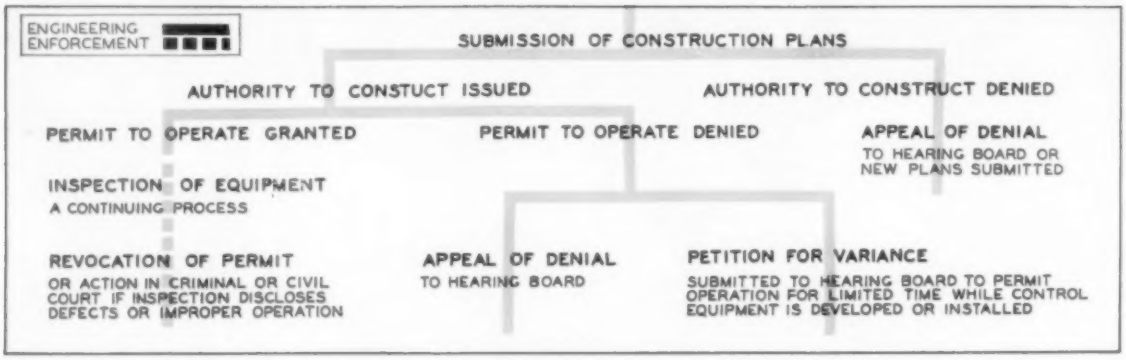
It would be difficult to overemphasize the fact that Los Angeles has a peculiar combination of meteorological factors which result in the formation of smog. These require that hydrocarbons be strictly controlled, a step not necessary in any community unless these unusual atmospheric conditions exist. In any case, a community should not embark on a Los Angeles-type of hydrocarbon control until they've done all the other obvious things.

In addition to controlling dust, fumes, and smoke, Los Angeles refiners must control the escape of hydrocarbons from such sources as storage tanks, oil-water separators, vacuum jets, relief valves, and pumps. The list is much longer (see Los Angeles case history), but this gives an idea of the scope.

Since the Air Pollution Control District was set up in 1947, rules and regulations have been added to the limits of scientific knowledge (and sometimes beyond). As was brought out by Robert Chase, of the APCD, at an October 31, 1957, federal congressional hearing on smog, he "didn't know of any rules that the APCD could pass which would materially affect the emissions of oil refineries."

Operating under the doctrine of "reduction at the source," air-pollution abatement in Los Angeles leans heavily on the permit system. Plans for new refinery equipment must be approved by the APCD before construction can start. It must again pass inspection before an operating permit will be issued (see diagram).

Police-power regulation, rather than the common-law doctrine of nuisance, is the basis for air-pollution control in California. Either through use of statutes and ordinances or administrative regulations, the state may interpose its authority to protect people and property. Enforcement thus takes the route of criminal prosecution (misdemeanor) rather than civil action via the injunction route.


ENGINEERING ENFORCEMENT
SUBMISSION OF CONSTRUCTION PLANS
AUTHORITY TO CONSTUCT ISSUED
AUTHORITY TO CONSTRUCT DENIED
PERMIT TO OPERATE GRANTED
PERMIT TO OPERATE DENIED
APPEAL OF DENIAL
TO HEARING BOARD OR NEW PLANS SUBMITTED
INSPECTION OF EQUIPMENT
A CONTINUING PROCESS
REVOCATION OF PERMIT
OR ACTION IN CRIMINAL OR CIVIL COURT IF INSPECTION DISCLOSES DEFECTS OR IMPROPER OPERATION
APPEAL OF DENIAL
TO HEARING BOARD
PETITION FOR VARIANCE
SUBMITTED TO HEARING BOARD TO PERMIT OPERATION FOR LIMITED TIME WHILE CONTROL EQUIPMENT IS DEVELOPED OR INSTALLED

THE PERMIT SYSTEM: How it operates when a Los Angeles refiner seeks to install any new equipment.

Los Angeles air-pollution-control authorities like police-power regulation, since no actual damage has to be proved to sustain a case. Courts have ruled that actual injury to health and property is not necessary to the proof of conviction and violation.

This preference was brought out by H. W. Kennedy of the APCD at a 1956 meeting of the Air Pollution Control Association in Los Angeles. Summed up, he declared that the power to grant or deny permits is the most effective weapon in the arsenal of air control officers. Enforcement of the law under the permit system is far more effective than occasional visits by a violator to the criminal courts he stated.

Los Angeles oil industry peopde, however, take issue with the idea that the permit system is the best way for a community to get clean air. They say it requires that the control district ride herd on every apparatus that "just might" put contaminates in the air. Their objection is that the disadvantage of making onerous requirements to permittees before they start any operation greatly outweighs the necessity of the controls obtained.

To put it another way, they claim the permit system requires controls before adequate proof of their necessity is obtained and that this proof lies in the minds of the administrators of the law rather than being determined by the courts.

To these who demur by pointing out that under the permit system the permittee has a right to go to court, industry people say they are forced to obtain the permits and install the necessary equipment a long period of time before they may get ultimate relief in the courts.

Furthermore, they say there is quite a difference between determining the necessity of a course of action through the courts and being forced to take action, the efficiency of which has not been shown, by the force of public opinion focused by an administrative bureau.

How the permit system can create an unnecessary hardship is exemplified by the millions of dollars Los Angeles refiners spent for controlling sulfur dioxide—a pollutant which later was shown to have nothing to do with the creation of smog. Had the injunction system been in effect rather than the permit system, industry people say this money would not have been needlessly spent.

Trends in other areas . . . Air-pollution controls should be based solely on local conditions. Severe regulations are needed in Los Angeles because of its unusual atmospheric and topographic conditions, the large number of automobiles, and its expanding population and industry. But to apply them to other areas would result in great unnecessary expense to the industry.

At one time last year, legislation to control air pollution was being considered in 52 cities in 26 states. In addition, nine states were considering statewide regulations of one kind or another.

New York, Philadelphia, Chicago, New Orleans, Cleveland, and San Francisco—cities with substantial refining capacity—all have passed ordinances or have them under consideration. The State of Washington last year passed a control law. New Jersey switched from mild to quite severe laws.

Most regulations pertained only to smoke and particulate matter control, or outlawed open burning. But they will no doubt be explained if industry does not better its aerial waste controls. Since communities tend to adopt entire regulations from other areas, there is danger of Los Angeles' severe regulations spreading to other cities.

In this connection, New Jersey adopted the Ringelmann chart as the basis for measuring the blackness of smoke—no stack can emit smoke of a greater density than Ringelmann No. 2.

This is the Los Angeles standard also. As an accompanying illustration shows, no black smoke of a density greater than Ringelmann No. 2 can be emitted for more than 3 minutes in any one hour.

But as the illustration also shows, it is unlawful to produce "white smoke, gray smoke, brown smoke, or any other smoke of 40 per cent opacity, or greater . . ." Thus the trend is toward regulating visible emissions on the basis of **opacity.** Where contaminants are too light in shade to come up to Ringelmann No. 2. smoke or any other contaminant "that is at least as hard to see through as smoke which is as dark or darker than Ringelmann No. 2," is now condemned. This provision has been upheld in several court tests.

The State of Washington in 1957 also adopted air-pollution controls. Unlike neighboring California's, these are based on civil action. The oil industry joined with other Washington industries in backing the measure.

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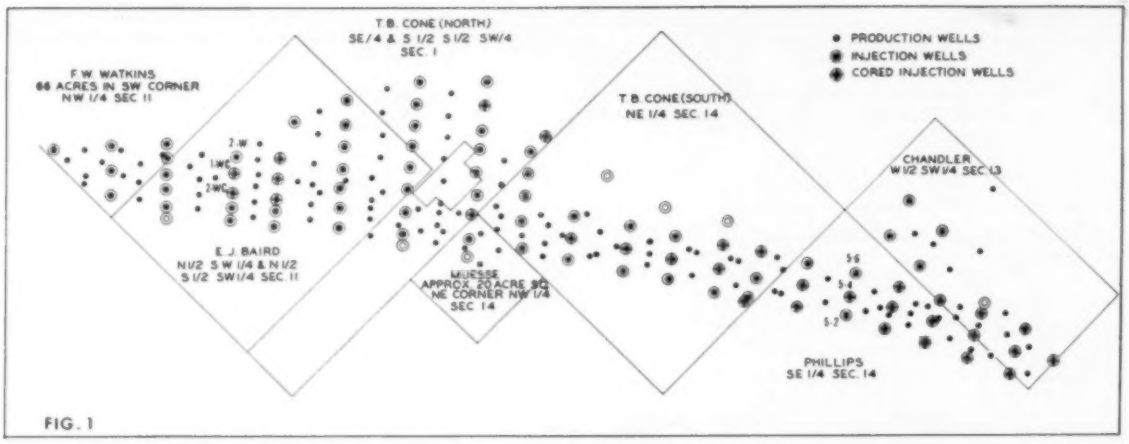


FIG. 1

Comparison of these two Kansas water-flood operations shows

Surfactant Can Hike Water-Injection Rate

By H. J. Schneider, H. L. Greenwald,
D. L. Felley, and R. F. Lollar

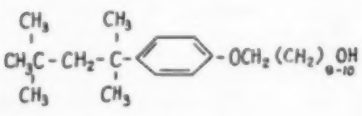
NONIONIC SURFACTANTS, added at 20 p.p.m. **from the start of the flood** enabled the operator to displace in 2 years about the same percentage of recoverable oil as obtained in 5 years in a control flood where surfactant was not used.

The control flood produced 425,894 bbl. of oil in 5 years, or 69.9 per cent of the estimated recovery by water flooding. The surfactant flood produced 102,501 bbl. of oil in 2 years, or 66.3 per cent of the estimated recovery by water flooding the smaller field.

The surfactant flood produced 3,296 bbl. of oil per acre and 0.26 bbl. of oil per barrel of water in the 2-year period. The control flood produced 3,086 bbl. of oil per acre and 0.23 bbl. of oil per barrel of water in the 5-year period.

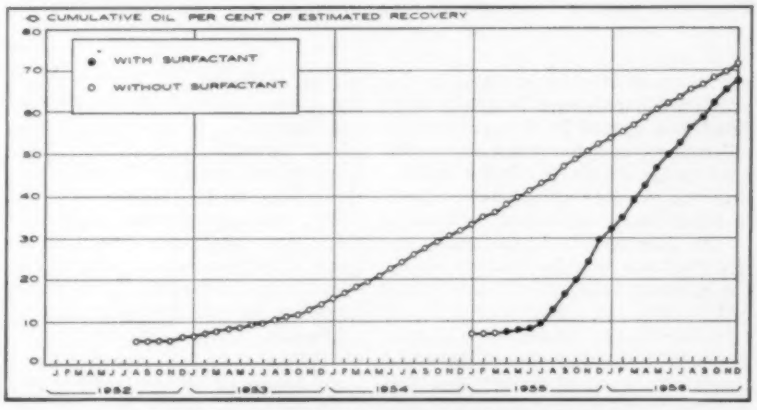
The two floods are located in the Paola shoestring of Miami County, Kansas (Fig. 1).

Joint effort . . . Rohm & Haas Co., in cooperation with the Maracaibo Oil Exploration Co., carried out the tests. Triton X-100, a nonionic detergent supplied by Rohm & Haas was used. It is a 100 per cent active, water-soluble reaction product of t-octylphenol with ethylene oxide.

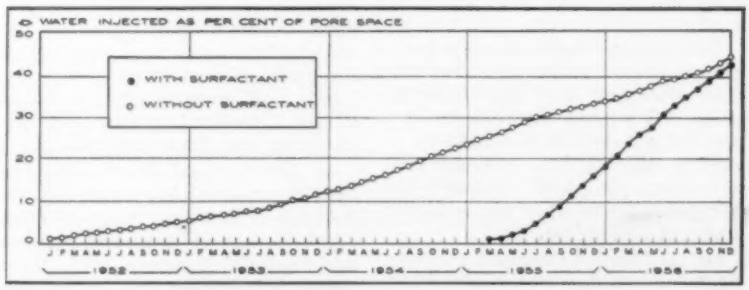


Several papers describing the use of this agent in water flooding and related studies have appeared.[1]

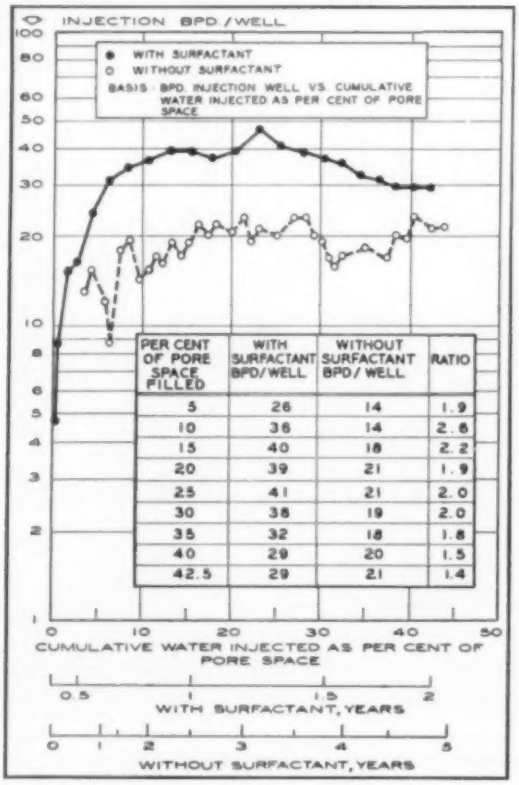
In any test where the surface-active agent is added to the injection water at the beginning of the water flood there is, of course, no base line of previous flooding history in the surfactant-treated reservoir with which the results obtained with the surface-



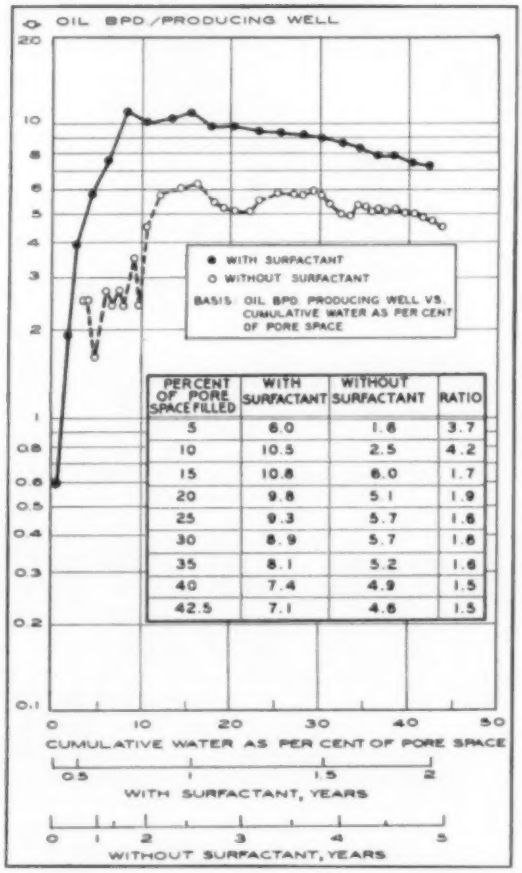
EFFECT OF SURFACTANT on oil production. Fig. 2A.



EFFECT OF SURFACTANT on injection. Fig. 2B.


INJECTION BPD/WELL
WITH SURFACTANT
WITHOUT SURFACTANT
BASIS: BPD INJECTION WELL VS. CUMULATIVE WATER INJECTED AS PER CENT OF PORE SPACE
PER CENT OF PORE SPACE FILLED | WITH SURFACTANT BPD/WELL | WITHOUT SURFACTANT BPD/WELL | RATIO
5 | 26 | 14 | 1.9
10 | 38 | 14 | 2.6
15 | 40 | 18 | 2.2
20 | 39 | 21 | 1.9
25 | 41 | 21 | 2.0
30 | 38 | 19 | 2.0
35 | 32 | 18 | 1.8
40 | 29 | 20 | 1.5
42.5 | 29 | 21 | 1.4
CUMULATIVE WATER INJECTED AS PER CENT OF PORE SPACE
WITH SURFACTANT, YEARS
WITHOUT SURFACTANT, YEARS

INJECTION results on barrels per day per well basis. Fig. 3.


OIL BPD/PRODUCING WELL
WITH SURFACTANT
WITHOUT SURFACTANT
BASIS: OIL BPD PRODUCING WELL VS. CUMULATIVE WATER AS PER CENT OF PORE SPACE
PER CENT OF PORE SPACE FILLED | WITH SURFACTANT | WITHOUT SURFACTANT | RATIO
5 | 6.0 | 1.6 | 3.7
10 | 10.5 | 2.5 | 4.2
15 | 10.8 | 6.0 | 1.7
20 | 9.8 | 5.1 | 1.9
25 | 9.3 | 5.7 | 1.6
30 | 8.9 | 5.7 | 1.6
35 | 8.1 | 5.2 | 1.6
40 | 7.4 | 4.9 | 1.5
42.5 | 7.1 | 4.6 | 1.5
CUMULATIVE WATER AS PER CENT OF PORE SPACE
WITH SURFACTANT, YEARS
WITHOUT SURFACTANT, YEARS

OIL PRODUCTION on barrels per day per well basis. Fig. 4.

active agent can be compared. To provide this reference base, the new flood was started in the same sand, adjacent to, and completed and operated under as nearly similar conditions as possible to an older flood in which no surfactant had been used.

The older flood (unitized flood) consisted of the Watkins, Baird, North Cone, South Cone, and Meusse properties (Fig. 1). The Phillips and Chandler leases made up the new flood. With the exception of the addition of 20 p.p.m. of surfactant to the water for the Phillips-Chandler leases, the water used in both floods was the same and originated from the same plant.

Well water, having a soap hardness of about 6,200 p.p.m. as calcium carbonate and total chlorides of 21,000 p.p.m., was subjected to conventional open-water treatment, involving chlorination, sedimentation with alum, phosphate treatment, and filtration. General water and corrosion problems were minor.

Authors Schneider, Greenwald, and Felley are with Rohm & Haas Co., and author Lollar is with Maracaibo Oil Exploration Co.

Line-drive floods . . . In both floods the general pattern of development was line drive. In the unitized area initial operation was on the Baird property and proceeded in both directions from a line 2-W, 1-WC, and 2-WC. The Baird, Watkins, and North Cone were developed first and the South Cone was started after a stay of 6-12 months. Over-all development, involving 64 injection wells and 62 production wells, was completed in 4½ years.

Development of the Phillips-Chandler leases began on a line 5-6, 5-2, 5-4 and proceeded with the same regularity as employed in the two different development programs for the unitized flood, and was completed in 1 year. As of January 1955, three injection wells were in operation in the Phillips-Chandler lease and 698 bbl. of water had been injected.

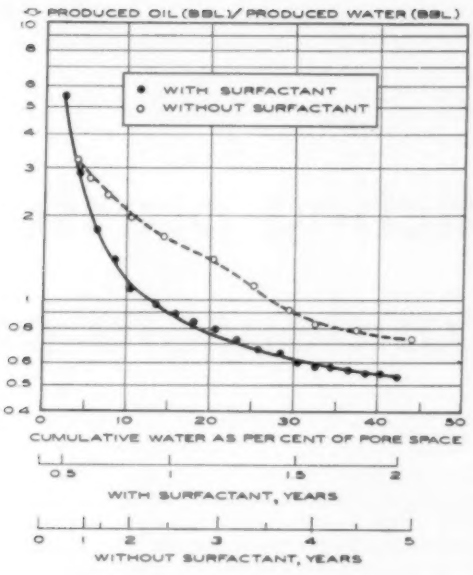
In February and March, six additional injection wells were brought in. Addition of surfactant began on April 15, 1955, and in April and May an additional 10 injection wells were started, bringing the total to 19. Thus, surfactant was present in the first injection water reaching 10 of the 19 wells in the Phillips and Chandler leases.

Geologic data . . . The Squirrel sand in which these wells were completed lies almost north to south at a depth of 600 to 700 ft. The top and bottom of the reservoir decline slightly from the Phillips-Chandler area to the north, but not sufficiently to have any bearing on the results of the flood. The average sand thickness is 20 ft. Some geological data on the two flood areas are shown in Table 1.

TABLE 1—GEOLOGIC DATA

	Unitized flood	Phillips-Chandler
Acres	138	31.1
Acre-feet of sand	2,663	547
Capacity, md.-ft. per well	950	1,353
Reservoir pore space, bbl.	4,130,750	930,600
Oil content, bbl.	1,653,300	384,000
Estimated recovery, bbl.	609,000	154,700
Primary production, bbl.	32,091	10,822
Injection wells	64	19
Producing wells	62	21

The capacity, millidarcy-feet, of the


PRODUCED OIL (BBL.)/ PRODUCED WATER (BBL.)
WITH SURFACTANT
WITHOUT SURFACTANT
CUMULATIVE WATER AS PER CENT OF PORE SPACE
WITH SURFACTANT, YEARS
WITHOUT SURFACTANT, YEARS

EFFECT of surfactant on produced oil-water ratio. Fig. 5.

average well in the Phillips-Chandler area appears somewhat higher than that of the Unitized Flood 3. Unfortunately, differences in the amount of coring in the two areas prevent a reliable comparison of the actual conditions. In the unitized flood only 15 of the 64 wells were cored and analyzed, in contrast to 17 of the total 19 wells in the Phillips-Chandler flood. The data in Table 1 are the averages of the cored wells which were somewhat scattered in the unitized area, as shown in Fig. 1.

In the completion and operation of the Phillips-Chandler properties there were some practices not generally used throughout the unitized flood. These include selective shooting of injection wells, fuel-oil treating, and use of automatic pumping in production wells, and have already been described.[1c]

However, comparison of the results on individual wells, in which the well completion techniques and production operations were the same, with the over-all results of the total fields suggests that no error is introduced if the areas are discussed as units. Consequently, this report is a general discussion of the two respective floods.

Flood Results

The unitized flood has been in operation for over 5 years, while the Phillips-Chandler flood has operated for only 2 years. The most important aspect of this study is that these two floods, both from the standpoint of water injected and oil recovered, have now reached approximately the same point in their flood histories as shown in Table 2.

The effect of surfactant in increasing the rate of injection and the rate of oil recovery is evident from Figs. 2A and 2B. Since the two fields are of different size, results are best compared by reducing all figures to a percentage basis. In the case of oil recovery, the cumulative oil is considered as per cent of estimated recovery.

Continuing under the same conditions, the curves would be expected to cross in 1957. However, since the beneficial effects of surfactant has been demonstrated, its use was halted, on December 31, 1956, in an effort to determine whether there is any continuing benefit from that which has already been injected.

TABLE 2—PRODUCTION DATA

	Unitized flood	Phillips-Chandler
Life of flood, years	5	2
Water injected, bbl.	1,817,518	391,829
Water injected, per cent of pore space	44.0	42.1
Oil produced, bbl.	425,894	102,501
Oil produced, per cent of estimated recovery	69.9	66.3
Oil produced, bbl. per acre	3,086	3,296
Oil produced, bbl. oil/bbl. water	0.23	0.26

There are many bases for a comparison of the results of injection rates of the surfactant flood with the reference flood. The data were compared on these bases: (1) injection rates per operating well, (2) injection rates per acre-foot, and (3) injection rates per millidarcy-foot.

Slight differences in well spacing between the two floods, uncertainty regarding the average value for capacity, millidarcy feet, and progressive expansion of the unitized flood, where new injection and production wells were brought in continually, made comparison of injection rates of the two floods in barrels per day per operating well the best method of comparison (Fig. 3).

Injection rates . . . The sharp rise in injection rate immediately following the start of injection of surfactant was due partly to raising the operating wells to full pressure. The considerably higher injection rate with surfactant when all the wells were on full, constant plant pressure of 660 psig. is, however, quite evident.

A rather sharp rise in the injection of the unitized flood occurred after 35 per cent of the pore space had been injected with water. This was due to breakthrough on five wells, which became runaways and took excessive quantities of water until they were selectively plugged.

Without this unfortunate development it is believed that the ratio between the injection rates per well in the two areas would have continued at a level of approximately two. Deletion of these runaway wells from the survey, with appropriate correction of injection rates, indicates that the unitized flood would have continued its expected downward trend.

Oil recovery . . . As shown in Fig. 4 the rate of oil recovery, on a barrels per day per well basis, for the Phillips-Chandler flood employing surfactant is never less than 50 per cent greater than the unitized flood, used as the control area.

At all times the produced water in the surfactant flood has been higher than that in the unitized control area. (Fig. 5.).

By increasing the rate of injection in the Phillips-Chandler leases the total operating costs were substantially reduced. Accounting methods employed have prevented any rigorous calculation of the dollor savings, but it has been estimated that operating expenses per barrel of oil produced in the Phillips-Chandler area were 20-45 per cent below corresponding costs in the unitized flood. The cost of the surfactant, used at 20 p.p.m., was 7 mills per barrel of oil produced, or 1.7 mills per barrel of water injected.

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(b) Dunning, H. N., Gustafson, H. J., and Johansen, R. T., Ind. Eng. Chem. 46, 591 (1954)
(c) Lollar, R. F., Prod. Monthly 21 (5), 26-34 (1957)

PIPELINES

An empirical method of

Predicting pressure drop in gas-condensate pipelines

BY A. L. BERRY and B. L. MOREAU

GAS AND CONDENSATE are recombined after dehydration for transportation in a two-phase gathering system handling wet sour gas for Westcoast Transmission Co., Ltd., in northeastern British Columbia.

This system consists of a 12-in. line to southeast Fort St. John field, an 18-in. line to Fort St. John field; and a 26-in. line northwest along the Alaska Highway, connected to a 20-in. line to West Buick Creek field. It transports some 300,000 M.c.f. daily of raw gas, plus several thousand barrels per day of liquid hydrocarbons.

It is commonly recognized that the transmission-pressure drops in a horizontal two-phase gas-condensate pipeline are greater than in a dry-gas line and that even relatively small amounts of liquid have a considerable effect. The factors contributing to this additional pressure drop are as follows:

- Energy lost by the gas in accelerating and transporting the liquid.
- Increased roughness caused by wetting the pipe wall and by waves on the surface of the liquid.
- Reduction in available flow area caused by the introduction of a liquid phase.

Pressure drops in the northeastern British Columbia system are expected to be higher because in hilly terrain additional energy is lost by the gas in lifting the liquid over each and every individual rise. This additional pressure drop appears to be dependent, to a very large degree, on the gas velocity in the pipeline.

Authors are senior plans and research engineer, Westcoast Transmission Co., Ltd., and production engineer, Pacific Petroleums, Ltd., respectively. Article adapted from paper presented at meeting of Engineering Institute of Canada, Banff, Alta., in cooperation with the ASME Petroleum Division.

Flow Patterns

There are six main types of flow patterns which have been recognized in two-phase flow. The various flow patterns are shown in Fig. 1. Assuming a horizontal pipe running full of liquid flowing initally so as to completely fill the pipe, and considering the effect of adding increasing volumes of gas, the type of flow to be anticipated is as follows:

... **1. Bubble flow,** in which separate bubbles of gas travel along the upper part of the pipe at approximately the same velocity as the liquid.

... **2. Stratified flow,** in which the liquid flows along the bottom of the pipe and gas flows above with a relatively smooth interface.

... **3. Wave flow,** which is similar to stratified flow except that the gas moves at a higher velocity and the interface is disturbed by a wave action.

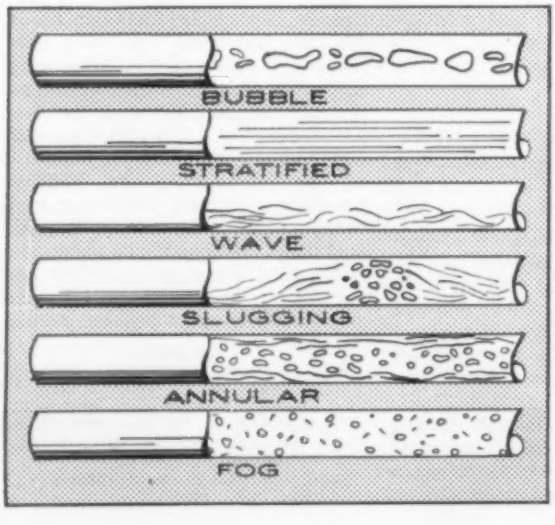
... **4. Slugging flow,** in which the interface level rises and falls and frothy slugs are formed periodically and pass along the pipe at higher velocities than the average liquid velocity.

... **5. Annular flow,** in which the liquid flows in a uniform film on the pipe wall and gas travels at a high velocity through the central core.

... **6. Fog flow,** in which most of the liquid is entrained as fog or spray by the gas at extremely high gas velocity. Sometimes called "dispersed flow."

Stratified and wave types of flow patterns are expected initially in the gathering system.

Relatively limited published data are available on two-phase pipelines operating at high pressures and most of these data are for practically horizontal lines. However, a study was made of operating data available on 4 to 16-in. high-pressure two-phase pipelines operating in Canada and the United States under somewhat similar conditions to those anticipated. It suggested an empirical approach to this problem of determining total pressure drop in the gathering system,



FLOW-PATTERN SKETCHES, HORIZONTAL TWO-PHASE PIPELINE

Fig. 1.

which is through predominantly rolling terrain.

Pressure Drop

The pressure drop in a two-phase line is calculated in two steps. Fig. 2 shows the effect of increasing amounts of condensate on the Panhandle Eastern flow-formula efficiency factor. It can be noted from this curve that even relatively small amounts of liquid which barely wet the wall of the pipe depress the efficiency factor to a considerable extent. This reduction in flow efficiency is for a horizontal line under stable flowing conditions.

The amount of liquid in the line at flowing temperature and pressure is determined from test or by flash calculation based on a knowledge of the composition of the gas. Ground temperatures are important since they affect the amount of hydrocarbons in the liquid phase. A survey of ground temperatures in the area indicated that the gas temperature in a pipeline buried 3½ ft. below the surface does not fall below 25° to 30° F. during the winter months, even though the frost line may reach 8 to 10 ft.

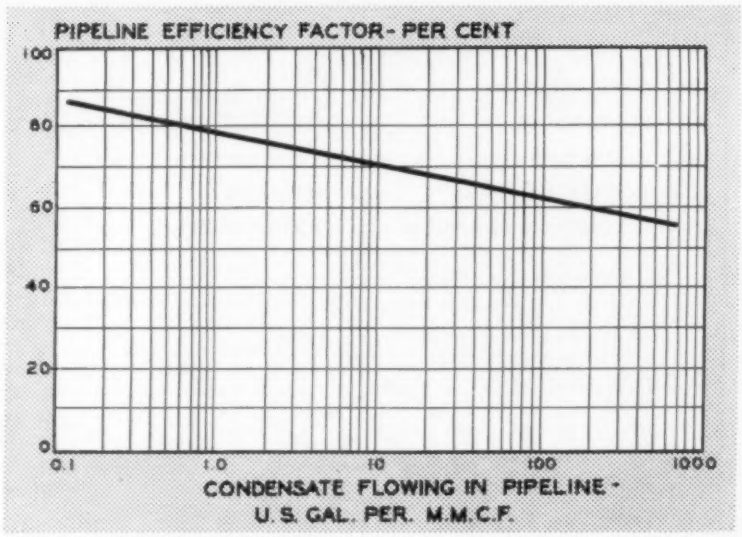
Fig. 3 illustrates the effect of gas velocity on elevation factor. The elevation factor can be defined as the percentage of total liquid head that appears as pressure drop over the line. The liquid head calculated from an accurate profile of the line is not the net change in elevation between the two ends of the line, but rather the sum of all the vertical rises.

The specific gravity of the liquid used in determining the total head on the line is determined by test or by flash calculation. The percentage of the liquid head then which will appear as pressure drop is a function of the gas velocity in the line and total pressure drop expected will be the sum of the pressure drop calculated for a horizontal line, plus that due to liquid head.

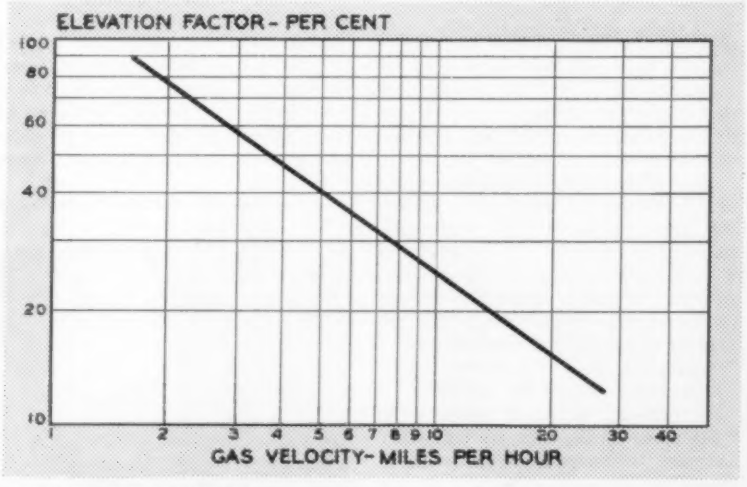
The type of result to be expected is illustrated in Fig. 4. An optimum flow is indicated for each size of line, assuming that stable flow conditions are allowed to develop. The optimum line size for any particular quantity of gas and liquid to be transported will depend on the vertical profile of the line.

This approach also indicates that total pressure drop in a two-phase line is not always reduced by increasing the line size. This becomes more apparent as the total of all the rises on the system becomes greater.

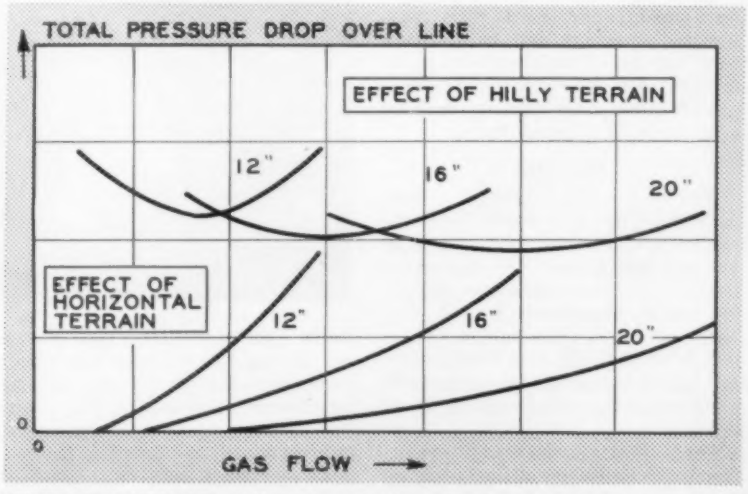
Although this approach to the matter of two phase pressure drop in a gas-condensate system is empirical, and more field-test data would be desirable, it is of considerable value in



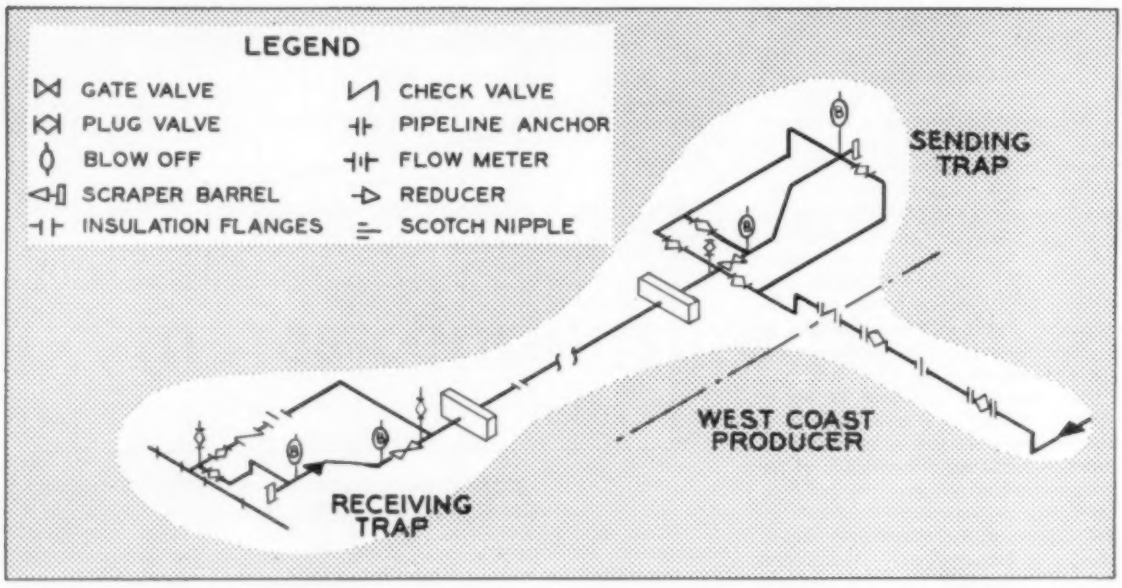
ILLUSTRATIVE REDUCTION in pipeline efficiency factor as the rate of condensate flow in horizontal pipeline is increased. Fig. 2.



ILLUSTRATIVE REDUCTION in elevation as gas velocity is increased. Fig. 3.



ILLUSTRATIVE EXAMPLE of the effect of hilly terrain in two-phase flow. Fig. 4.



TYPICAL GATHERING LINE showing pigging facilities. Fig. 5.

selecting the line size and in predicting the total pressure drop. This is especially true where the largest portion of the total pressure drop is due to the effect of terrain and pipeline velocities do not exceed 10 m.p.h.

The provision of a separate liquid line paralleling the longer main gathering lines would provide extra gas-carrying capacity for future expansion with a minimum of compressor horsepower. The liquid would be removed at the various points where the gas flowing in the line had reached ground temperature, where no further liquid condensation would be expected. A back pressure would of necessity be maintained on the separate liquid line in order to achieve minimum pressure drops by preventing flashing of the liquid.

Since the elevation effect on some lines can be quite severe, extra grading and spanning can be justified. Line location to avoid extreme elevation changes is a very practical approach to reducing operating costs by reducing total pressure drop.

Operation

The system will operate at a comparatively high load factor, since the major portion of the load is at a 90 per cent load factor. The long main-transmission line necessitates gathering system dispatching 1 to 2 days ahead of actual consumption. There will be in the order of 1 billion cubic feet of gas in line storage in the gathering and transmission system at all times.

Fig. 5 illustrates the type of pigging facilities installed on all main gathering lines in Alberta and British Columbia such that on-stream pigging can be accomplished without interrupting the normal flow of gas. It is believed that periodic cleaning of the pipeline will be required to maintain pipeline design efficiency. However, in the wet gas system, routine pigging will not be relied on to materially reduce liquid holdup in the line, thereby maintaining over-all pressure drops less than those anticipated under reasonably stable flow conditions.

THREE MOTOR-DRIVEN triplex pumps are putting LPG in three input wells in Pembina field in Alberta, Canada, for Canadian Bishop Oils, Ltd., one of first oil companies in Canada to use miscible-phase displacement for secondary recovery.

The pumps operate at about 1,000 psi. which enables a flow of more than 20 g.p.m. with a 15-hp. motor. About 75,000 bbl. of propane are being trucked in for use in a 640-acre block over a period of 2 or 3 months. Natural-gas injection will follow. Wells in this field average 5,000 to 5,500 ft. in depth.

ELEMENTS OF FIELD PROCESSING—48

Calculation of Enthalpy—2

BY DR. JOHN M. CAMPBELL
University of Oklahoma

IT IS OFTEN impossible to find a suitable enthalpy chart for the system being studied. Consequently, it is necessary to turn to fundamental equations which describe enthalpy in terms of pressure, volume, and temperature.

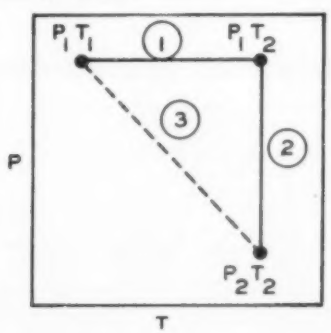
One of these equations is:

$$\Delta H = \int_{T_1}^{T_2} C_p\, dT + \int_{P_1}^{P_2} \left[V - T\left(\frac{\partial V}{\partial T}\right)_P \right] dP$$

Equation 1

where C_p is defined as the heat capacity of the system at constant pressure and is normally expressed as B.t.u./lb./°F.

This equation is not as formidable as it appears, for it really does nothing more than divide the enthalpy change between P_1T_1 and P_2T_2 into two steps—constant temperature and constant pressure.



The first integral takes care of Path 1 and the second, Path 2. The change in enthalpy is, furthermore, the same as if some path (3) is taken, since enthalpy depends only on the initial and final conditions. Paths 1 and 2 are therefore arbitrarily taken, for they are calculable and convenient.

Equation 1 is subject only to any inherent limitations in trying to describe the first law of thermodynamics. It also applies only where no phase change takes place between P_1T_1 and P_2T_2. Where such a change occurs, the process must be broken up into steps in which no phase change occurs and those where a change occurs at constant temperature and pressure.

The quantity C_p is a symbol for the expression $(\partial H/\partial T)_p$, which means that it is a measure of the rate of change of enthalpy with temperature at constant pressure. For constant pressure, Step 1 $\int C_p\, dT$ represents the enthalpy change.

C_p is a function only of temperature and is commonly expressed by equations of the form:

$$C_p = A + BT + CT^2$$

where A, B, and C are constants that depend on system composition and T is the temperature in °R.

In most instances it is sufficiently accurate to find a C_p at the average temperature T_a, where $T_a = \frac{T_1 + T_2}{2}$. C_{pa} is then found at this average temperature and $\int C_p\, dT = C_{pa}(T_2 - T_1)$. This approximate solution to the first integral, although not exact, is satisfactory for most lease applications. Values of suitable average values of C_{pa} will be shown in succeeding installments.

The last term is more complex and may only be integrated graphically or numerically. Fortunately, however, it may often be eliminated without loss of appreciable accuracy. For an ideal gas, it may be shown that $V - T \times (\partial V/\partial T)_p$ is equal to zero. Consequently, for an ideal gas, ΔH depends only on temperature, the last term being zero. Although there are no ideal gases, actual gases behave in an ideal manner ($PV = nRT$) below 50 psig. Therefore, below 50 psig.:

$$\Delta H = \int C_p\, dT = C_{pa}\, \Delta T \quad (2)$$

The last term is substantially zero for liquids, since there is little change in volume with temperature. Equation 2 is also then valid for liquids. If this fact is remembered, all pressure changes may be taken on liquid in stepwise calculations, thus eliminating the need for solving the second integral. Future calculations will illustrate this procedure.

For changes in enthalpy accompanying a phase change at constant pressure and temperature, an equation may be developed by application of sound thermodynamic principles. After conversion to consistent units, it reads:

$$dP/dT = 5.40\, [\Delta H_L/T(V_g - V_L)] \quad (3)$$

where:

P = pressure, psia.
T = temperature, °R.
ΔH_L = enthalpy change, B.t.u./lb.
V_g = specific volume vapor, cu. ft./lb.
V_L = specific volume liquid, cu. ft./lb.

This is commonly known as the Clapeyron equation.

dP/dT is the slope of the vapor pressure curve in the vicinity of the temperature at which the phase change occurs. A plot of vapor pressure versus temperature on regular coordinate paper is not a straight line, so the slope is really the tangent to this curve at the desired temperature.

Where specific volume data are not available, V_L may be eliminated from Equation 3 without any appreciable error, since it is quite small in comparison to V_g. Then:

$$V_g = \frac{10.73\, ZT}{pM} \quad (4)$$

where M = molecular weight of gas = (28.97) (specific gravity).

The only data needed for calculation of ΔH_L are now vapor pressure data in the vicinity of the temperature at which the phase change occurs.

Example: Determine ΔH_L for a water system at 240° F. and 25 psia.

Solution: Reference to a steam table or vapor pressure chart shows the following data:

P, psia.	T, °F.	T, °R.
15	213	673
20	228	688
25	240	700
30	250	710
35	259	719

A plot of these data is shown in Fig. 1. The slope of this curve at 240° F. equals 0.445. For steam:

$$V_g = \frac{(10.73)\,(1)\,(700)}{(25)\,(18)} = 16.7$$

(Assuming Z = 1.0 below 50 psia.)

Therefore:

$$0.445 = \frac{5.40\, \Delta H_L}{(700)\,(16.7)}$$

or $\Delta H_L = 963$ B.t.u./lb.

This is very close to the 952 B.t.u./lb. shown in the steam tables. The most critical part of this calculation is determination of slope. If this is done very carefully, Equation 3 yields accurate values of ΔH_L.

DRILLING

Gas search quickens in North Arkansas

"With the 'continuous drill-stem test,' few shows of gas are overlooked during drilling operations, even though the shows are not evident in the samples."

BY NORMAN S. MORRISEY, Drilling-Development Editor

AIR AND GAS drilling operations have permitted operators to step up their search for new gas reserves in Northwest Arkansas. Deeper pay zones, tough drilling, lack of a pipeline outlet, and low price for gas at the wellhead have all been contributing factors to curtail a rapid expansion of the province. But recent developments indicate operators are gambling on Northwest Arkansas as a good bet for future gas reserves. In the first 11 months of 1957, approximately 1 million acres were leased. During the past 5 years, operators have snapped up all available acreage on the surface structures in a belt 80 miles wide and 150 miles long that stretches east from the Oklahoma-Arkansas line.

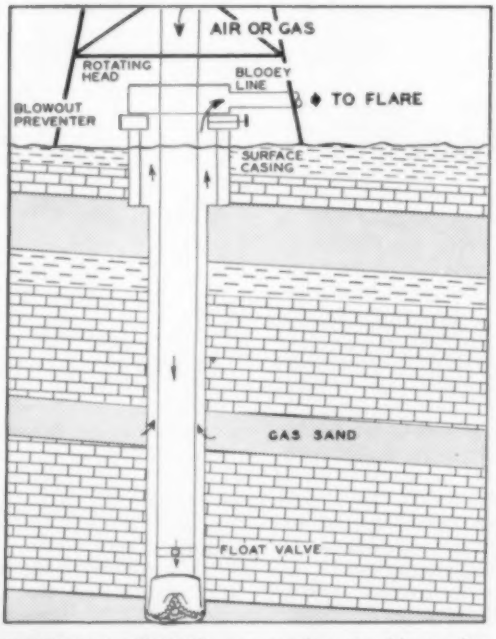
Currently some 20 rigs are active in Northwest Arkansas. Principal operators are Carter Oil Co., Stephens Production Co., Gulf Oil Corp., Murphy Oil Co., Athletic Mining & Smelting Co., and Reynolds Metals, but several other companies are moderately active such as Pure Oil Co., Sunray Mid-Continent Oil Co., Phillips Petroleum Co., Panhandle Pipeline Co., and Arkansas Western Gas Co.

Formerly most of the drilling in the area was by cable tools. The tough sands and shales made rotary drilling abnormally expensive for the depths. Now, however, operators are reporting good to excellent results using either air or gas. Water zones are still a problem that often force operators to revert to mud as a circulating medium, but new techniques give promise of reducing or eliminating this headache.

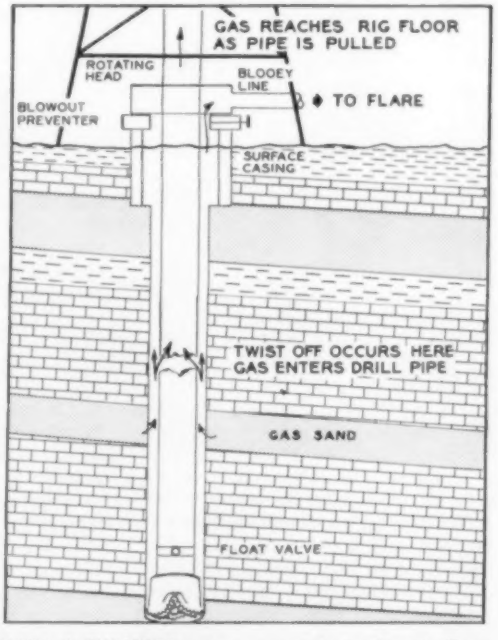
One way to combat the water zones is to drill with cable tools or with rotary using mud until through all the water zones, then to convert to air or gas drilling after setting an intermediate string. Operators are looking to new plastics or other cementing material as a possible means of sealing off the troublesome water during air and gas drilling.

Drilling conditions in Northwest Arkansas are highly variable with drilling depths ranging from shallow 1,200-ft. wells to deep 9,000-ft. wildcats. On top of that, the penetration rates are extremely difficult to fore-

Safety measures used by Gulf to prevent explosions



IN NORMAL DRILLING, gas reaches the blooey line through the annulus; none gets to the rig floor . . .



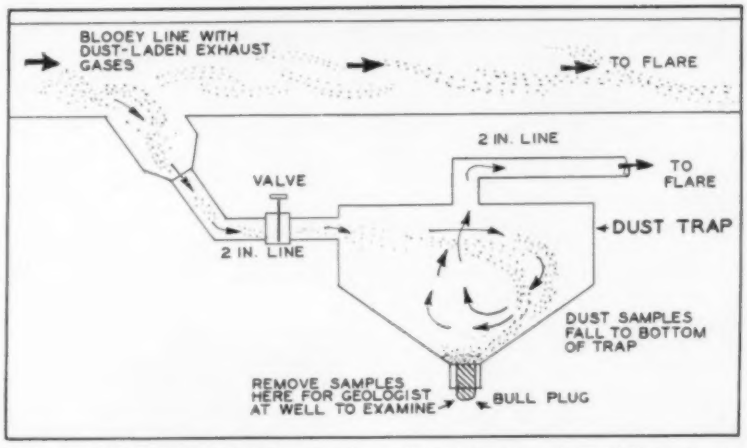
WHEN A TWISTOFF occurs, gas gets to the rig floor through drill pipe, setting up possible explosion . . .

cast. A recent test in Massard field drilled the 120-ft. pay sand in 3 days using only three bits. But an offset, 1 mile away, required 10 days and 18 bits to drill the same 120-ft. sand section. At Massard, the pay sand is found at 5,000 ft. As a result, all wells are drilled on a day-work basis rather than on footage rates.

Acreage situation . . . The initial land rush has passed in Northern Arkansas. When it first became apparent that the area had a definite potential, the most favorable surface structures were quickly leased up. Most companies were starting from scratch and used the same state and USGS publications as a guide to map out their lease programs and to outline their buying areas.

The net result has been that available acreage on the more obvious surface anticlines is now under lease. Most operators admit that there are undoubtedly scattered tracts within their blocks that are open. The problem, however, is to ascertain the mineral owners and to locate them. And land men familiar with the area are quick to point out the difficulties of locating these owners and the task of establishing their interests.

Now operators who are moving in Northern Arkansas are forced to lease north and south of what is considered the fairway for gas production. Some of the latecomers are even playing the north edge of the Ouachita fold belt that extends across southwestern Oklahoma and into Arkansas. This is more from necessity than from choice. Few sizable tracts are still open except in these less desirable areas. although a successful wildcat either in the Oklahoma or Arkansas portion of the Ouachita Mountain front would quickly change these land values.



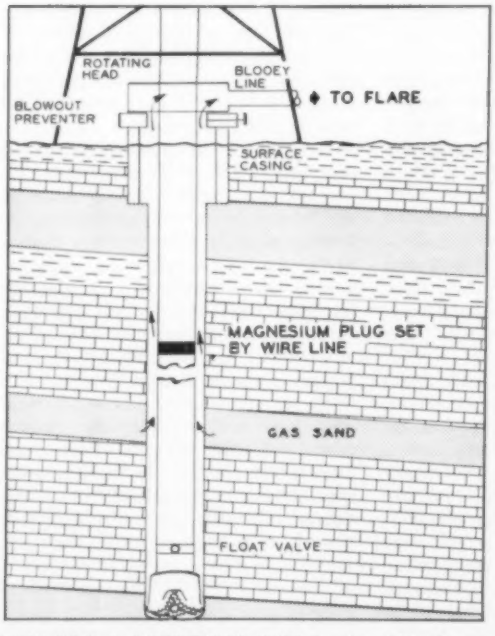
ONE TYPE OF SAMPLE TRAP that works well during air and gas-drilling operations. Samples collect in the swage-shaped trap and can be removed easily. Fig. 2.

Drilling problems . . . No new oil or gas province is without its drilling problems, and Arkansas follows this rule. Hole deviation on the large surface structures can become troublesome, although with 640-acre spacing, the problem is not an acute one as a rule. But with hole deviation come related problems, dog legs, stuck drill pipe, reduced penetration rates, etc.

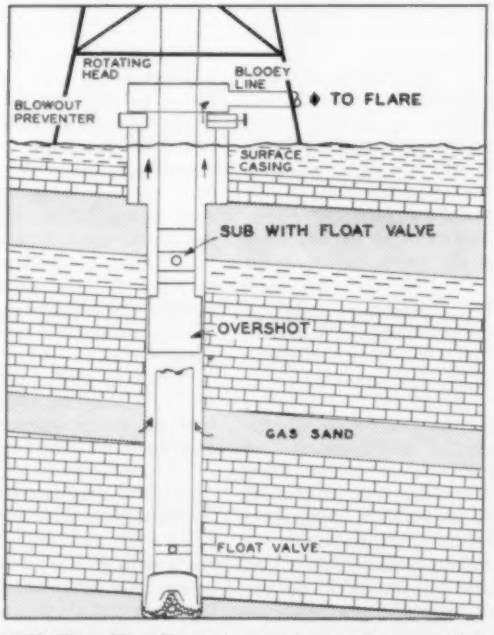
The Atoka and Morrow rocks are not easy to drill through. The shales in particular are sandy or silty and about as tough to drill through as the sandstones. Tungsten-carbide bits have given good results in drilling through these hard zones.

Another problem has been loss of circulation, particularly when converting over from air or gas drilling

on the rig floor during fishing operations. Fig. 1



GULF SETS A MAGNESIUM PLUG in the drill pipe to eliminate this danger . . .



RECOVERY OF FISH with overshot is then possible. Note float valve in sub above overshot.

to a conventional mud system. As one operator put it, "You don't simply pour some mud down the hole and start turning to the right. It may take us 2 weeks to get the hole in good enough shape to drill ahead." Most standard lost-circulation material is used more or less successfully in northwestern Arkansas. Cottonseed hulls is a favorite, possibly because it is in abundant supply.

The rugged terrain, too, contributes to the high cost of Arkansas wells, since roads can be expensive. The rugged surface outcrops that delineate the structures cut the countryside up into steep hills and deep valleys or gulleys that extend for many miles. It makes the surface geologist's task easy, but complicates exploitation.

Troublesome water zones, too, slow drilling operations, particularly if the circulating medium is air or gas. Sometimes it is possible to dry up the water zone, but often the contractor is forced to change over to a mud system to complete the hole.

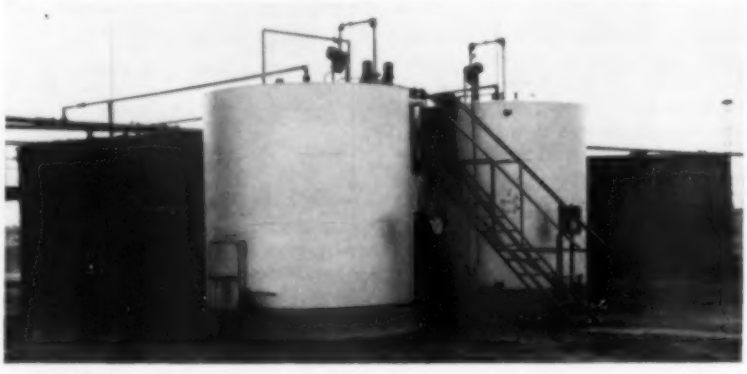
And with the water zones is the added hazard of stuck drill pipe and resulting twistoffs. The fishing, of course, slows down drilling operations and makes the over-all well cost higher. Usually it is possible to recover the drill pipe with an overshot.

Gulf Oil Corp. has instituted an unusual safety measure, as shown in an accompanying illustration. Invariably gas comes back up the drill pipe to the rig floor when a twistoff occurs. During normal drilling operations, a float valve prevents gas from coming up the drill pipe. Instead, it goes up the annulus and out the blooey line.

However, once the pipe is ruptured, some of the gas reaches the rig floor through the drill pipe, creating a fire and explosion hazard as the pipe is pulled. Gulf sets a magnesium plug in the drill pipe just above the twistoff, using standard wire-line equipment. This plug prevents the gas from reaching the rig floor and it is an easy matter to pull the drill pipe safely. During fishing operations, of course, Gulf puts a sub with a float valve above the overshot and recovers the pipe in the hole.

Operators like air drilling for several reasons. First, it is usually cheaper since they get better penetration rates, contractors use fewer bits, there is less trouble with hole deviation, twistoffs, etc. In addition, they point out that with air drilling, you get a continuous drill-stem test. The flare at the end of the blooey line is an excellent means of spotting any shows of gas. Even at best, the operators point out, it is difficult to pick up shows in well cuttings under the microscope.

In air drilling, the problem is more difficult because the wellsite geologist is looking at dust samples rather than rock chips. Collecting the dust is a problem, although Arkansas operators are able to get good samples using setups similar to that shown in Fig. 2. With the "continuous drill-stem test," few shows of gas are overlooked during drilling operations, even though the shows are not evident in the samples.



ORIGINAL BATTERY scores 1,138 constant-volume deliveries to pipeline.

First LACT unit star performer

ON DECEMBER 27, 1957, Gulf Oil Corp.'s lease in Kansas, with lease automatic custody transfer, LACT produced its December allowable and was automatically shut down, thus completing a full 2 years of lease automatic custody transfer operation. The first automatic sale of oil in the United States was made by Gulf in cooperation with Kaw Pipe Line Co. on December 22, 1955.[1]

In the 24-month period following the initial sale from the LACT battery, a total of 128,520 bbl. of oil, or an average of 177 bbl. daily, has been run to the pipeline. The allowable has been produced each month. Operation has been automatic and on an unattended basis. The system employs two parallel measuring tanks with weir - controlled, constant - volume measurement. Accessories include b.s. and w. monitor, temperature and pressure-recording instruments, sampling device, electrical programer, allowable stop, and necessary fail-safe devices.

Operating difficulties have been minor, usually requiring slight adjustment of equipment or infrequent replacement of programer components. No mismeasurements have been made. Automatic temperature recording and sampling have provided accurate data.

Paraffin, deposition during the winter months in the b.s. and w. monitor probe, sampler, and small-diameter lines proved to be somewhat of a nuisance. Periodic cleaning of the affected parts maintained items in good working condition. Insulated heating cables have been wrapped around the probe and critical parts of the sampler, greatly reducing paraffin deposition. Incrustation on the interior surfaces of the plastic coated measuring tanks has been negligible.

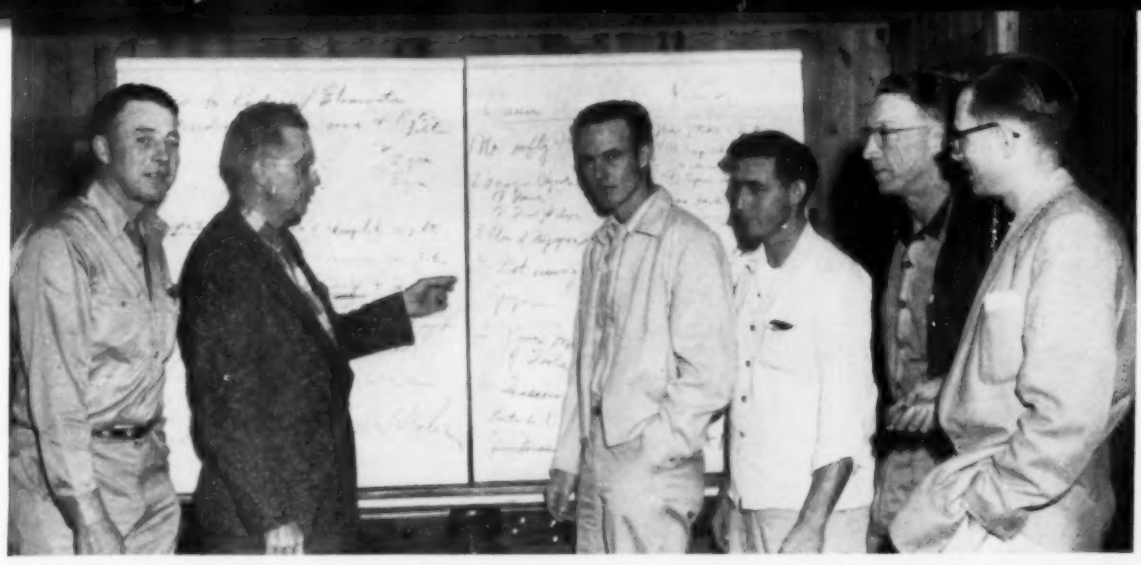
In the double-weir system provision was made for b.s. and w. accumulations below the lower weir. In the 24 months of operation only 17 bbl. of b.s. and w. and oil were cleaned from the tanks. As compared to operations before LACT, this was a reduction of 95 per cent in tank-cleaning operations, equivalent in increased revenue to some $400 per year.

Run tickets are prepared weekly and therefore gager visits are limited to one per week. On this weekly schedule the number of tickets prepared has been reduced by 70 per cent compared to operation before LACT.

In 2 years of automatic, unattended operation the LACT battery has made 1,138 constant-volume deliveries of oil to the pipeline. Temperature, b.s. and w. and gravity determinations have been accurate. All wells have been shut down automatically each month when the allowable has been sold. Only minor operating difficulties have been experienced. The accuracy and dependability of this type of LACT system has been well proved.

Reference

1. Lease Automatic Custody Transfer Becomes a Reality. S. H. Pope and R. M. Stuntz, Jr., Gulf Oil Corporation, The Oil and Gas Journal, April 23, 1956.



QUARTERLY DRILLING CONFERENCES are held by Carpenter-Trant Drilling Co. to upgrade personnel and improve efficiency. Shown here at such a conference are John Anderson, field superintendent; Mike Powers, director of business and industrial services, University of Oklahoma; A. B. Killpack, R. G. Stork, and C. F. Koch, driller; George E. Mendenhall, Jr., treasurer and vice president.

Drilling clinic solves problems

By **NORMAN S. MORRISEY**
Drilling-Development Editor

QUARTERLY CONFERENCES between management and tool pushers and drillers to upgrade personnel and build more efficient crews work for Carpenter-Trant Drilling Co., Denver. The technique pays off, according to George E. Mendenhall, company vice president and treasurer. He points out that tool pushers on the last two rigs put into operation by Carpenter-Trant were former drillers who had attended several of these conferences and were promoted from within the organization.

Carpenter-Trant approaches the conference from a constructive viewpoint, attacking a problem and finding the possible solutions. The approach smacks of "brainstorming", although the solutions and improvements are practical and down to earth because the participants are drilling personnel and supervisors who are thoroughly familiar with field operations.

The usual approach is to assign topics to conference leaders, the drillers and tool pushers as a rule. The conference on each topic lasts 30-35 minutes and each man attending leads a session. Topics chosen are of current interest to the drilling company and crews; often the session arrives at a solution to some company problem. Primary purpose of the conference is to improve communications within the company.

Carpenter-Trant approaches the conference with the "how to do something" technique. For example, at a recent conference, one of the topics was "How to Cut Rig-Up Time." The conference leader pointed out the various causes of a slow rig-up, such as:

Location not ready.
Lack of plan for rig move.
Lack of proper moving equipment.
Poor teamwork.
Breakdown of moving equipment.
Lack of proper moving equipment.
Lack of blueprints.
Poor arrangement of equipment.

Doing repair work on rig that could have been done at some other time.

Then the conference discussed ways to speed up the present procedure with specific recommendations:

Better communications.

Start plan from top down to last man.

Don't leave repair work and rig maintenance until moving time.

Check moving equipment in advance to insure it will be adequate.

Train crews so that each man will know his job.

Standardize blueprints.

Rearrange equipment in advance to save time during move.

Another problem tackled was "How to Improve Fuel-Pump Repairs." Here again, the conference leader pointed out the causes for breakdown: Dirt in oil, lack of oil, improper care of pumps, dirty fuel filter, dirt in fuel, etc. Prevention suggested was:

Daily maintenance.
Change filters regularly.
Keep fuel lines clean.
Use clean can for adding new oil.
Proper training of personnel.

The problem of "Good Housekeeping" was also treated. The conference leaders showed why good housekeeping was necessary:

Speeds up operations if rig is in tiptop condition.
Reduces expense of maintenance.
Shows pride in company.
Safety measure.
Men's attitude toward their work improves.

The group then discussed various methods of improving their housekeeping around the rig with suggestions like:

Clean every chance you get.

Use steam hose to clean rig floor, equipment, etc.

Paint rig and equipment when time permits.

After each conference held between management and supervisors, the group makes suggestions on how the different leaders can improve their methods of communicating. The company feels that this "evaluating" pays off in better communications when the tool pusher or driller leads company meetings at a later date and helps the supervisor get his ideas over more effectively on the rig floor.

PLATFORM DRILLING in Lake Biscarrosse in the Aquitane basin typifies current development of Parentis field.

TYPICAL PUMPING UNIT used in producing oil from Parentis field from a depth of about 7,200 ft.

Europe's biggest field halts pressure decline by water injection. Now producing 26,834 bbl. daily

By Joseph A. Kornfeld
Consulting geologist-engineer, Tulsa

PARENTIS oil is produced from two Lower Cretaceous carbonate reservoirs. This French field is owned and operated by Societe Esso de Recherches d'Exploitation Petrolieres (ESSO REP).

Parentis field is situated in the Aquitane basin which lies in the northern foreland of the Pyrenees Mountains. Orogenic movements which built up the Pyrenees gave rise during middle Eocene time to folds in the belt of the foreland. The intensity of folding decreased northward. Folds now concealed within the Aquitane basin were truncated by erosion and subsequently overlapped by Miocene marine and lacustrian muds and piedmont formations.

Structure of Parentis field is that of an elongate anticline. The field extends for a length of 7 miles along its east-west structural axis. It is 2 miles wide from north to south. A major strike fault cuts the south side of the field. This condition is verified by 2 Parentis encountering a fault zone. Moreover there is extremely good reservoir communication among most of the wells lying on the south side of the field. Seismic surveys have indicated the presence of another major fault on the northeast flank of the anticline, and 24 Parentis has cut this fault which has a bearing of N 30° W.

The producing oil reservoirs at Parentis have an oil column of 1,201 ft. The highest subsea position is recorded in 11 Parentis at —6,672 ft. A field-wide oil-water contact of —7,872 ft. has been established from well-completion data and core analyses.

Upper oil reservoir . . . Oil production is found within the basal portion of a carbonate sequence in the Lower Cretaceous system.

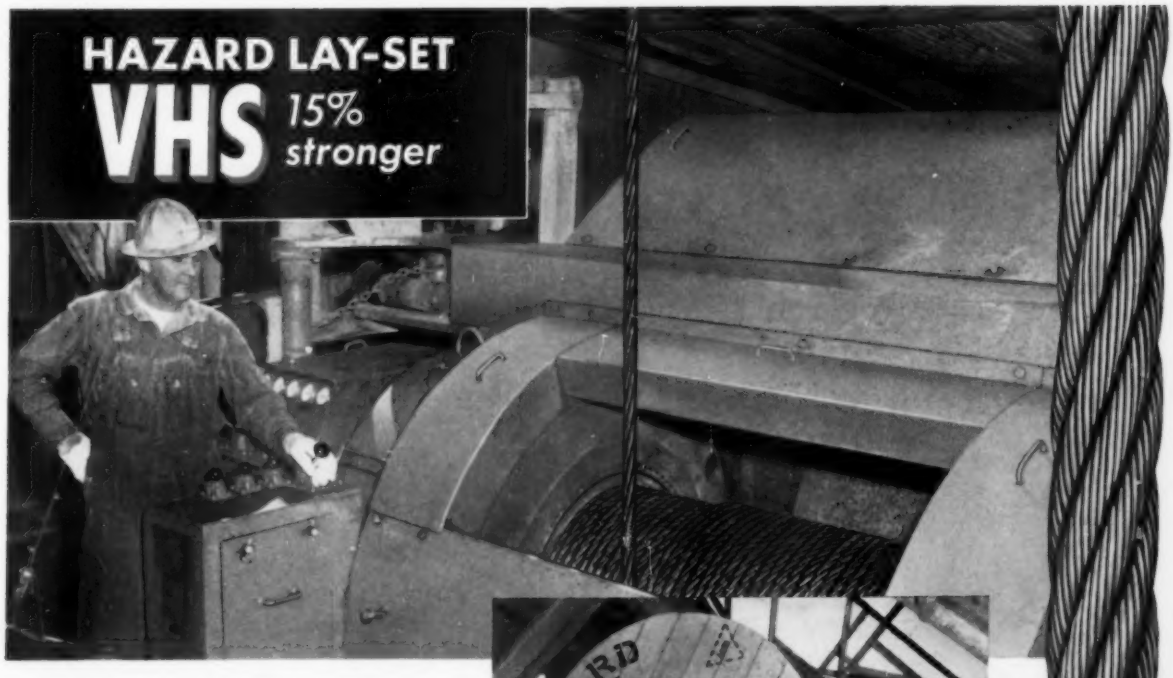
The upper portion of this carbonate sequence is a fine-grained, intergranular limestone which exhibits small, vertical fractures. This pay zone is separated by a series of dense limestone and shale breaks. The total productive interval of this upper oil zone varies from 266 to 754 ft.

Lower oil reservoir . . . Oil production from the lower oil reservoir occurs over an interval which ranges up to 600 ft. above the field oil-water contact of —7,872 ft. The lower zone is comprised of highly dolomitized limestone. Porosity types include cavernous, vugular, and fracture. Permeabilities range up to 2 darcies as determined from core analysis.

Individual productive units are separated by dense, compact, impervious dolomitic limestone or dolomite. The highest individual well productivities in the entire field are obtained from the central area from wells completed from this lower, highly fractured oil reservoir.

The original reservoir pressure at

HAZARD LAY-SET VHS 15% stronger



How to get MAXIMUM Service from Rotary Drilling Lines with MAXIMUM Safety . . .

Now—thanks to HAZARD wire rope engineers—you can set up a carefully controlled program that will give you maximum service and safety from rotary drilling lines. How is this done? By following the same 3-point control program that has helped hundreds of other drillers achieve record-breaking Ton-Mile performance from drilling lines. Here's all you do:

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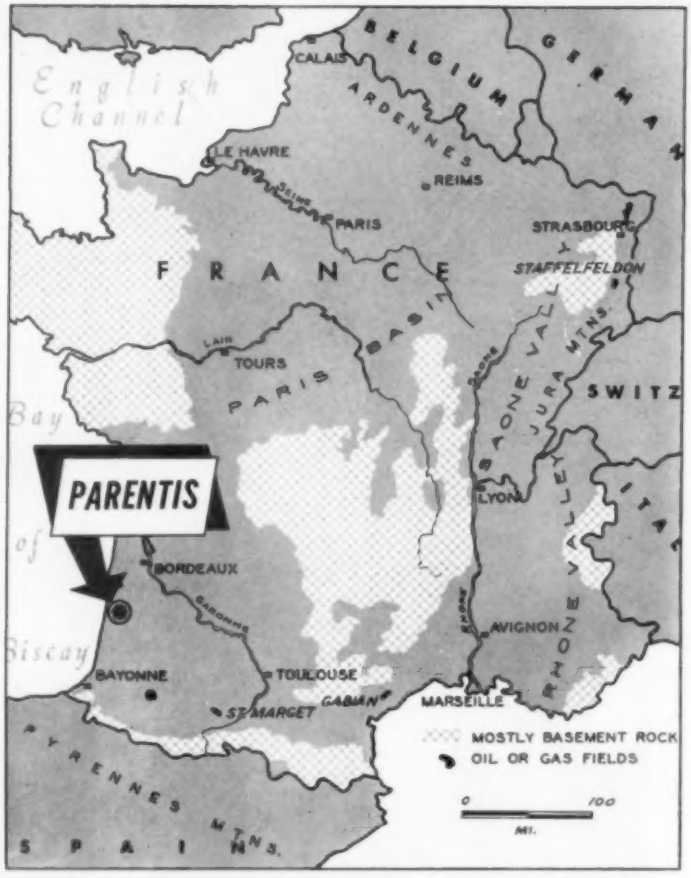


SEDIMENTARY BASINS of France are shown in this geographical map.

discovery date on April 24, 1954, measured at 3,210 psig., had declined steadily to the present field average reservoir pressure of 2,940 psig. measured at field datum plane of —7,216 ft.

Present water-injection rates totaling 12,569 bbl. of water per day, have halted reservoir pressure decline. The future pressure history of the Parentis oil field will be dependent upon (1) expansion of the present peripheral flood; (2) anticipated oil producing rate schedules, and (3) future water-injection rates.

Water-Injection History

In the fall of 1956, after observing the steady decline in field reservoir pressures, Esso engineers first attempted water injection into 12 Parentis. This well was deepened from 7,874 to 8,858 ft. Then an effort was made to inject 6,280 bbl. of water per day under 1,000 psig. into the formation, but it was not successful.

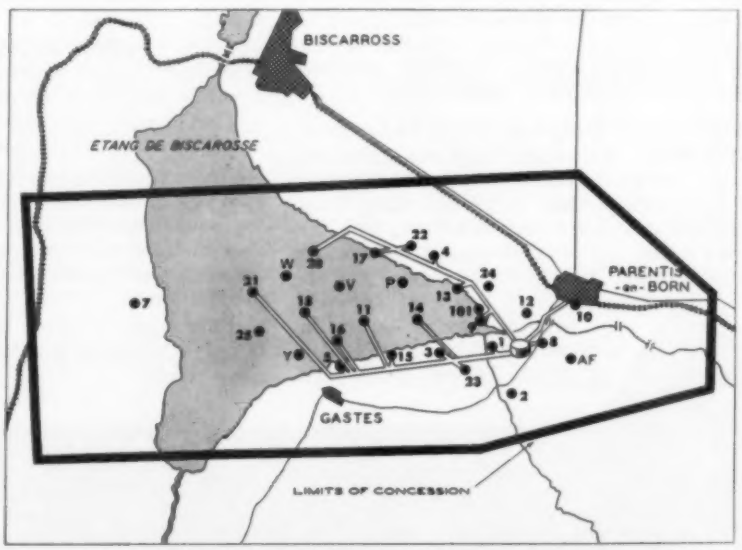
Pilot injection well . . . Initial injection well was 27 Parentis, a marginal well on the south side of the field. Injection work was commenced in March 1957 and during the first month, 15,724 bbl. of water per day was injected. The following month, injection rates were lowered to an average of 12,579 bbl. per day. Then injection rates were reduced steadily in this well to 6,290 bbl. per day, the current input rate. All water is being injected into an aquifer below the oil-water contact which is at the base of the lower oil reservoir.

Injection project enlarged . . . The first 3 months of pilot injection history at 27 Parentis was satisfactory and this early performance encouraged Esso engineers to enlarge the pilot program. Thus in June 1957, 30 Parentis in Lake Biscarrosse was converted to injection service. Water was introduced into this well at the rate of 12,579 bbl. per day **under vacuum.** Intake rates were then increased the following months to an average of 18,869 bbl. per day.

Esso plans to complete a third injection well in the field, in Lake Biscarrosse, to extend the flood on a peripheral plan. It is anticipated that two additional injection wells will be drilled during 1958. Water-injection rates totaled 12,579 bbl. per day for the two injection wells combined, at the time of this report.

Injection wells are pretreated with acid opposite the upper intergranular limestone oil reservoir being placed in service, in order to improve injectivity index.

Water supply . . . All of the injection water is fresh water produced from Lake Biscarrosse which covers most of the field surface area. In 30 Parentis situated on the lake, water



DETAIL oilwell location map of Parentis field and Lake Biscarrosse.

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is picked up by a centrifugal pump mounted on a production platform, metered, then injected through a 4-in. tubing set in an 8-in. cased hole. At present, the injection water is not treated. However, a filtration plant is being planned.

Drilling Program

Borehole program . . . A 20-in. hole is cut to a depth of 95 ft. where a string of 16-in. conductor pipe is set. Then the shoe is drilled and a 15-in. hole is cut to 656 ft. where the 11¾-in. casing is set. A 9⅞-in. hole is cut to 7,216 ft. where the 7-in. casing is set.

Completion method . . . Originally the oil string was set on top of the oil reservoir. However, at the end of 1955, 1 year after discovery, it was found that it would be advantageous to penetrate the formation for a total of 328 ft. before setting the oil string. In this manner the casing would blank off 262 ft. of limestone and 33 ft. of interbedded shale. Consequently, all current completions are drilled with rotary through the entire reservoir then selectively gun-perforated for production.

The logging program includes the conventional electrical log, induction log, Microlog, Laterolog and section gage. Both the dipmeter and the photoclinometer are run in fault zones. For completion operations, the maximum recording thermometer, the gamma ray, neutron log, and casing-collar locater are run.

All of the injection water is introduced into an aquifer below the oil-water contact which lies at the base of the lower oil reservoir. Two oil reservoirs are influenced by pressure maintenance operations:

Upper oil reservoir: A fine-grained, intergranular limestone intercalated with a series of dense limestone and shale breaks, of Lower Cretaceous age.

Lower oil reservoir: A fractured, vugular, cavernous, dolomitic limestone of Lower Cretaceous age.

The current field oil rate of 26,834 bbl. per day from 23 producing oil wells represents an average of 1,167 bbl. per well per day. It is believed that enlargement of pressure maintenance operations will enable operation of the field at the present field oil rate without damage to the oil reservoirs.

Market outlet . . . Oil produced from Parentis field is transported by a 12-in. crude-oil pipeline extending for 50 miles from the field to Bordeaux where the crude is transferred to a storage tank farm and tanker terminal. From the latter point, crude is pumped into Esso tankers for movement to the Point Jerome refinery of Esso Standard Societe Anonyme France. The crude charging capacity of this refinery is 85,000 bbl. per day.

PARENTIS PRESSURE-MAINTENANCE DATA SUMMARY
Lower Cretaceous Age

Water Supply Source: Lake (fresh water)	Biscarrosse
Type of flood	Peripheral
Pay depth, ft.	7,216
Injection water rates, bbl./day/field	12,579
Injection water rates, bbl./day/well	6,290
Present injection wells, No.	2
Ultimate injection wells, No.	5
Date pilot injection commenced	March 1957
Date pilot injection enlarged	June 1957
Type of injection well	Perforations below oil-water contact
Pre-treatment of injection well	Acidization
Original reservoir pressure, (datum —7,216 ft.) psig.	3,210
Present reservoir pressure, Aug. 1957 (—7,216 ft.) psig.	2,940
Cumulative decline in reservoir pressure, Aug. 1957, psi.	270

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Acknowledgments

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Jacques Jeunot, district engineer, Societe Prospecion Electrique, at the Lue (alndes) France office furnished logging-procedure data.

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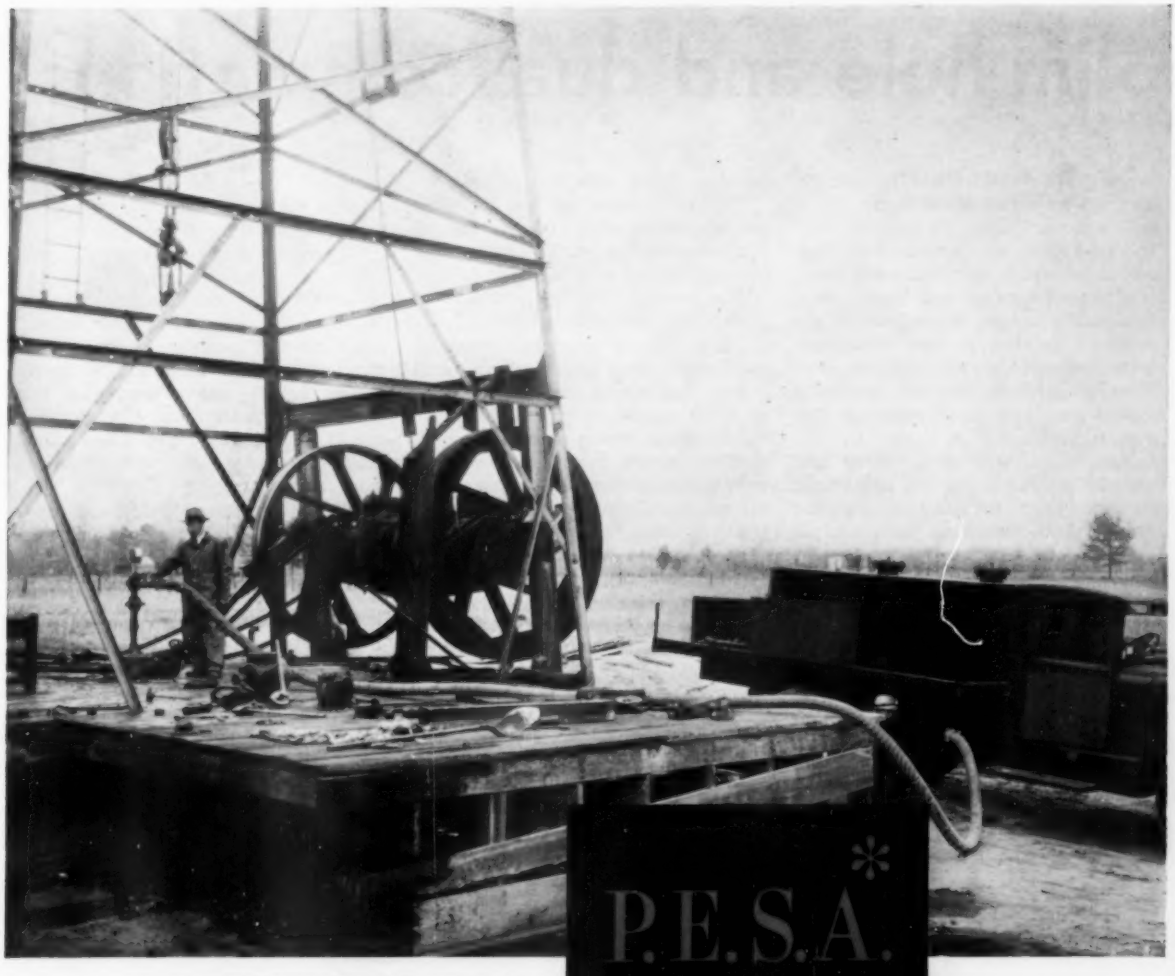
Early well stimulation methods increased oil recovery



Scenes like this were becoming common in West Texas by 1933, within a year after the first well was commercially acidized in Michigan.

In 1932, production soared from 90 to 790 bopd on the second oil well ever to be treated with acid. News of this Michigan well spread so fast that within a year, acidizing was widely used in the Permian Basin.

Billions of barrels of oil, and trillions of cubic feet of gas have been recovered as a direct result of acidizing and more recent fracturing treatments. These reserves might otherwise have remained locked in the earth.

Much credit for these achievements goes to you producers who were willing to gamble your wells in an effort to increase recovery, but such successes would not have been possible if research had not developed suitable inhibitors.

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PROUD TO BE PART OF A PIONEERING INDUSTRY

On small-production leases, consider

Slim-hole and dual completions

BY DEWEY FOLLETT
Creole Petroleum Corp.

INFLATION, increased drilling costs, increased material costs, and contract obligations on leases of a less-prolific nature have greatly accelerated interest in dual and slim-hole completions. No problem now remains unsolved for the successful completion and production of this type of well.

Ordinarily, a gin-pole pulling unit may be utilized to pull the lightweight tubing string; affording a complete workover in minimum time and at nominal cost.

Selecting tubing size . . . Each field and often each well must be considered as an individual problem from the production standpoint. When smaller tubing is used, it will give a reduced maximum total fluid, as shown by these actual observed rates of production for various sizes of tubing and lift conditions:

2½-in. tubing—2,600 bbl. of fluid per day, lifting with 700 psi. gas.

2-in. tubing—1,700 bbl. of fluid per day, lifting with 700 psi. gas.

1½-in. tubing—700 bbl. of fluid per day, lifting with 800 psi. gas.

1¼-in. tubing—425 bbl. of fluid per day, lifting with 600 psi. gas.

1-in. tubing—200 bbl. of fluid per day, lifting with 500 psi. gas.

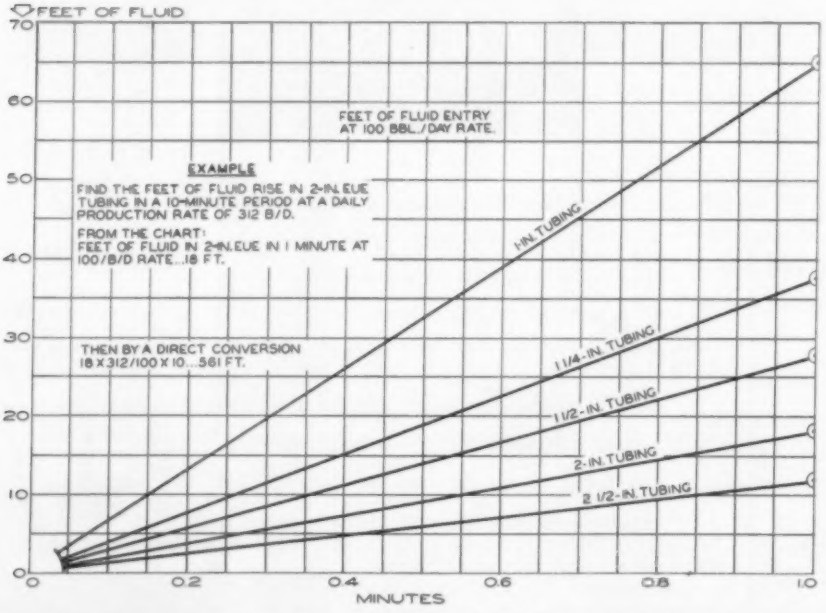
These figures represent observed production rates under certain conditions and should not be interpreted as being maximum production possible for these tubing sizes.

When a well ceases to flow of its own accord, the smaller tubing strings afford less effective area, thus practically limiting the means of artificial lift to gas-lift valves. The rate of fluid feed-in becomes a prime consideration. Fig. 1 shows that the rate of feed-in is more than doubled for the same production when one changes from 2 to 1¼-in. tubing, and almost quadrupled by going to 1-in. tubing.

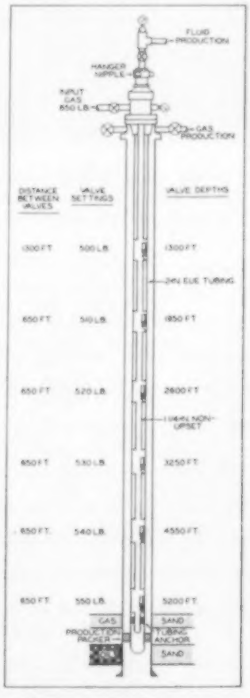
This accelerated feed-in presents a different problem, insofar as casing-pressure-operated gas-lift valves are concerned. The annular space between tubing and casing is substantially reduced, and means smaller volumes of gas are available for lifting. Simultaneously, the gradient for constant flow in the tubular string approaches extreme values rapidly.

Spacing of casing-pressure-operated valves with gas-lift formulas present no problem in larger-diameter casings. In slim-hole completions and macaroni-tube dual completions, however, the volume and clearance between tubing collars and casing must be taken into consideration. Further, the gas in its path down to the operating valve must pass one of these restrictions at every joint of tubing. The small annular volume of gas is rapidly dissipated in the vicinity of the operating valve.

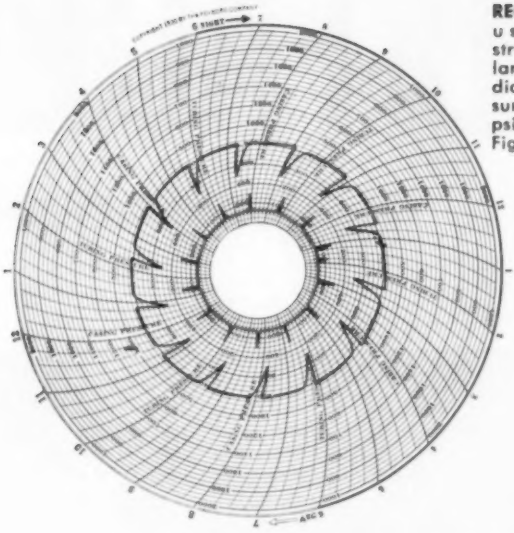
Valve setup . . . Macco Oil Tool Co. has set up a spacing formula for fluid-operated valves which has been proved in many installations of both standard-size and slim-hole completions. In this formula, only the first valve is located the same distance from the surface as dictated by the accepted method. The balance of the



FLUID FEED-IN RATE rises sharply with reduction of tubing size from 2½ to 1 in. The chart is based on the same production in all sizes. Fig. 1.



FLUID-OPERATED valve installation. Fig. 2.



RECORDER CHART for well using 1½-in. macaroni string with modified collars inside 2-in. tubing, indicates annulus gas pressure falls more than 350 psi. each time well kicks. Fig. 3.

valves are spaced equidistant down the tubing string using the available gas pressure in feet as a basis for setting (1 ft. per lb. of gas available). A typical installation is shown in Fig. 2.

The valves operate independently of casing pressure and depend entirely on the fluid in the tubing to effect their opening. Because of this, they will either inject gas continuously, or will automatically intermit, depending on the well's ability to produce fluid. The well may pass through a period of flow in which no gas is injected (when flowing gradient is sufficient); the valves start injection as soon as the flow gradient reaches a value that requires gas to maintain production.

Valves work in a well from the twilight period through the constant-flow range, and begin intermitting automatically when the operating depth exceeds that of constant flow. In most cases this eliminates one workover to change from constant flow to intermitting valves.

The valves are increased in opening pressure down the tubing string to utilize the available gas energy. When a well reaches the intermitting stage, fluid rise in the tubing opens the lowermost operating valve. This starts a head of fluid toward the surface. As the head passes the next valve up the string, it also opens, giving the fluid added velocity. This occurs as each valve is passed utilizing all the available gas energy in the restricted annular space.

No physical separation between the valve and the fluid in the tubing is necessary. The valve is mounted in a capsule-type mandrel equal in outside diameter to that of the tubing string collars. Since these valves are opened solely by the fluid, they are completely exposed to the fluid and require only a small lug inside the capsule to secure them. This mandrel yields an equivalent bypass diameter greater than 1-in. tubing when run inside 2-in. casing. When 1½-in. tubing is run inside 2½-in., an equivalent diameter of almost 1¾-in. is realized.

Operating results . . . Table 1 shows some results obtained using these valves. Well B produced 312 bbl. total fluid through 1½-in. tubing. Referring back to Fig. 1, it is seen the feed-in rate for 1¼-in. tubing is 37.5 ft. per minute at 100 bbl. per day. So for 312 bbl. per day the rate is 37.5 × 3.12, or 118 ft. per minute. Since the 1¼-in. tubing is set at 4,753 ft., it takes about 40 minutes for the fluid to travel the full length of tubing. It would have taken almost an hour and a half for this fluid to reach the surface in 2-in. tubing.

This illustrates the rapidity at which a well must be produced through smaller tubing strings. This well is constant flowing in the 1¼-in. tubing. This same total fluid through 2-in. tubing could be produced by intermitting the well every 20 minutes.

The recorder chart of Fig. 3 was taken on Well C. It illustrates a point previously made regarding annulus gas volumes. The macaroni string in this case is 1½-in. with modified collars inside 2-in. tubing. The annulus gas pressure in this installation falls more than 350 psi. each time the well kicks. In doing so, only 2,200 cu. ft. of gas is dissipated from the annulus, yielding about 1 bbl. of oil.

This is a small volume of gas when one considers that average 2-in. intermitting installations under the same operating pressure conditions could be expected to inject several times this amount per kick. The 2-in. installation would drop the casing pressure perhaps 50 psi. Here, the 350 psi. drop illustrates that the small annular volume of gas is utilized to its fullest extent.

As soon as the fluid clears the tree, an immediate drop in tubing pressure effects the closing of the valves until another head accumulates.

TABLE 1—RESULTS FROM USING FLUID-OPERATED VALVES

WELL	PRODUCTION (B/D)			INPUT GAS M.C.F.	INPUT G.F.R. C.F./B.	OUTPUT GAS M.C.F.	FORM. GAS M.C.F.	FORM. G.O.R. C.F./B.	CHOKE TUBING	TUBING PRES. P.S.I.	SEPR. PRES. P.S.I.	FLUID OPERATED VALVE INSTALLATION
	OIL	WATER	TOTAL									
A	21.62	0	21.62	37.0	1710				OPEN	290 MAX.	40	8 VALVES 1-1/4" TUBING TO 7428'
B	61.53	250.82	312	87.2	279	152	64.8	1053	3/4	150	100	7 VALVES 1-1/4" TUBING TO 4753'
C	11.00	0	11.00	30.6	2780				OPEN	150 MAX.	60	6 VALVES 1-1/4" TUBING TO 5510'
D	42	67	109	21.5	197	90.5	88	1636	15/64	250	150	4 VALVES 1-1/2" TUBING TO 3000'
E	17	59	76	59.0	776				OPEN			4 VALVES 1" TUBING TO 3175'
F	64.29	209.28	274	32.4	119	90.9	58.5	910	19/64	240	100	7 VALVES 1-1/4" TUBING TO 4802'
G	30	280	310	83.7	270				OPEN			3 VALVES 1-1/4" TUBING TO 2970'
H	52.33	175.18	228	34.9	153	74.9	400	764	15/64	350	100	7 VALVES 1-1/2" TUBING TO 4938'
I	63	187	250	25.0	100				OPEN		60	6 VALVES 1" TUBING TO 4995'
J	65	200	265	93.0	350				14/64	250	50	4 VALVES 1-1/4" TUBING TO 3915'
K	126	0	126	13.0	100				8/64	250	50	3 VALVES 1" TUBING TO 3002'
L	47	350	397	151	380				20/64	300	50	3 VALVES 1-1/4" TUBING TO 2534'

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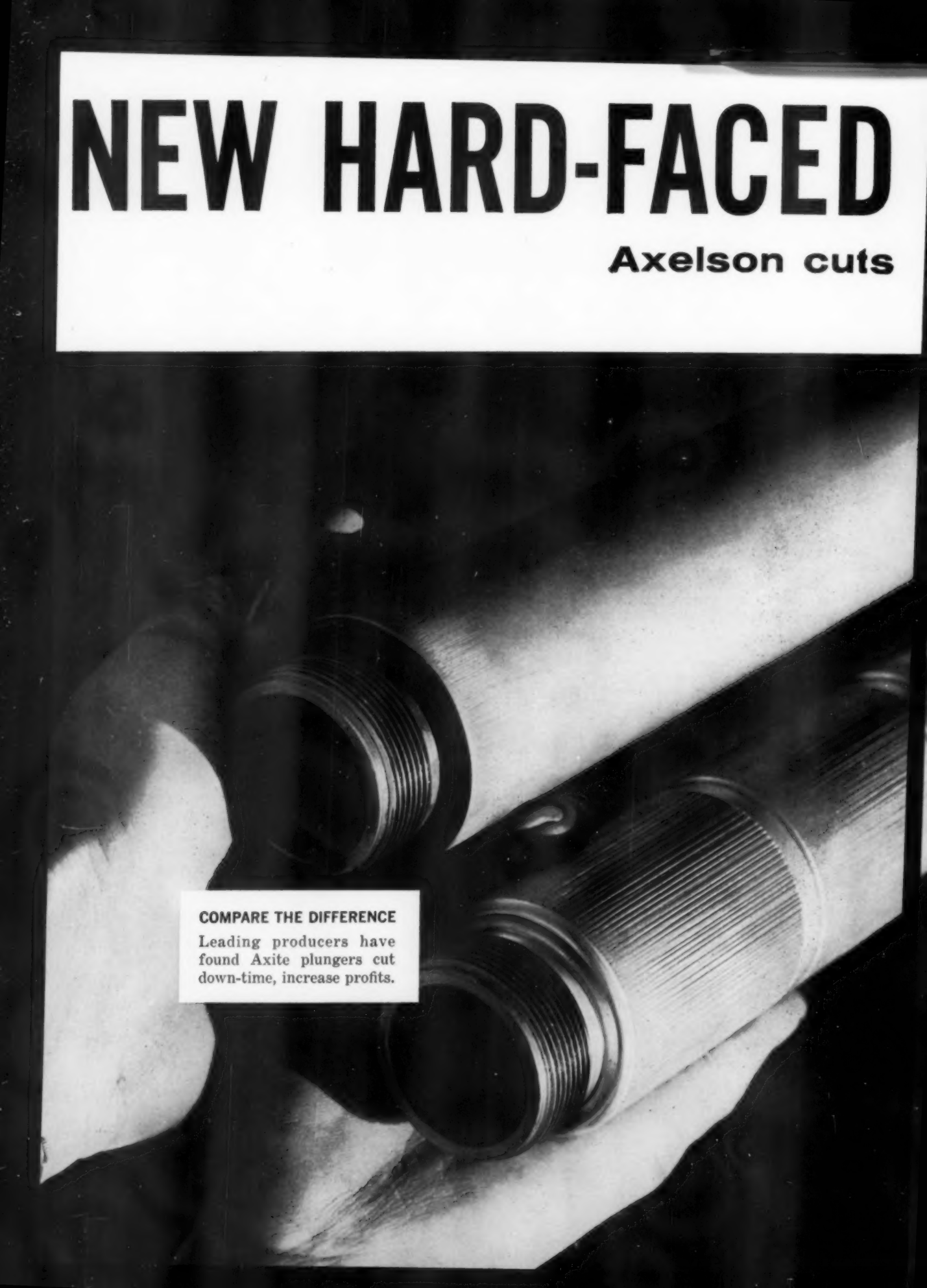
NEW HARD-FACED

Axelson cuts



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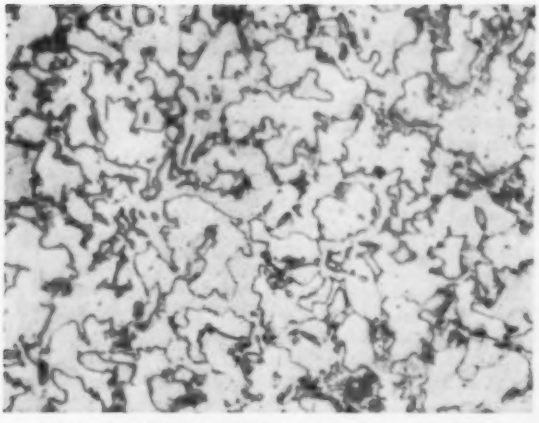
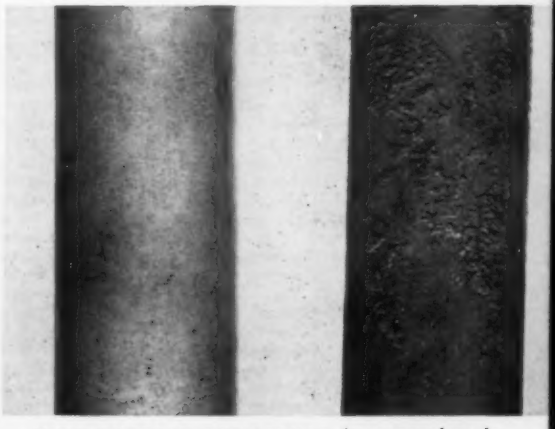


DIAMONDS have a hardness of 10 on the Mohs scale. The new Axite plunger has a hardness of 9. Detail above (magnified 500 times) shows a completely integrated metal surface. Carbide and boride particles—dispersed throughout the alloy—are four times harder than Rockwell "C" 62 reading indicates.



HIGH SURFACE RESISTANCE to corrosion is demonstrated in this comparative photo. After seven days of submersion in a concentrated hydrogen sulfide solution, Axite plunger remains clean and smooth while plunger made of other material shows deep pitting. When I. D. and pin face are nickel-plated, the Axite plunger is virtually impervious to all forms of corrosion.

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BY W. L. NELSON, Technical Editor

Questions on TECHNOLOGY

Cost of Refinery Chemicals

Catalyst and additive materials are getting to be more and more expensive. Can you indicate the cost of refinery chemicals during 1940 so that we can make comparisons?—S.G.T.

The processes that were used during various years are indicated in Table 1. The table shows approximate dates at which each process was first conducted, the date at which the process became the regular practice, and the main chemicals used in the process. Up to the year 1930, the main chemicals were sulfuric acid, clay or bauxite, caustic, oils, fats and fatty acids, soda ash, and litharge (although between 1888 and 1925 considerable copper oxide was used in desulfurizing gasoline). By 1940, this list was extended to include lime, cracking catalysts, lube-oil additives, and solvents. The emergence of various chemicals into significant positions is indicated in Table 2. Sulfuric acid is the most important chemical. Its importance began to decrease during the 1930's but the practice of alkylation has been maintaining the position of acid.

In constructing Table 2, a detailed estimate of chemical consumption was made for the year 1956. The year 1940 could be handled relatively easily by reference to a report by Petroleum Administration for War which was described on the Questions on Technology page of January 5, 1950, page 74. Quite good information is available regarding sulfuric acid, caustic, and soda ash consumption, and this permitted estimates of other years such as 1930 and 1950. Approximate costs (cents per pound) were selected and the weighted average price (cents per pound) of refinery chemicals was computed as shown in the last lines of Table 2. Thus, in 1930, the average cost of chemicals was only 1.19 cents per pound whereas a corresponding price in 1956 was 5.95 cents per pound. The rise is caused to some extent by inflation but mainly it is due to the more expensive

TABLE 1—INITIATION AND PRACTICE OF PROCESSES THAT REQUIRE CHEMICALS

Date	Material	Treatment	Chemicals
1870 (1855-)	Light oils	Acid treat and neutralize	Sulfuric acid, caustic soda
1880 (1860-)	Lubes	Acid treat and neutralize	Soda ash
1896 (1888-1925)	Gasoline	Frasch copper oxide	Copper oxide
1915 (1910-)	Light oils	Acid treat and rerun	
1915 (1910-)	Lubes	Bauxite and clay percolation	Fuller's earth, bauxite
1915 (1910-)	Light oils	Doctor sweetening	Caustic, litharge, sulfur
1922 (1912-)	Light oils	Clay stabilization	Fuller's earth
1925 (1922-)		Thermal cracking	Lime, caustic
1926 (1923-)	Gasoline	TEL blending	TEL, ethylene dichloride
1928 (1926-)	Gases	Desulfurization	Ethanolamines, soda ash, sodium phosphate, sodium phenolate
1925 (1915-)	Greases	Compounding agents	Various oils, fats, etc.
1928 (1923-)	Lubes	Clay contact	Fuller's earth
1928 (1918-1936)	Gasoline	Hypochlorite sweetening	Sodium hypochlorite
1928 (1924-)	Kerosine	Edeleanu treating	Sulfur dioxide
1930 (1925-1938)	Gasoline	Gray vapor-phase treating	Fuller's earth
1931 (1925-)	Gasoline	Dyes	Various dyes
1932 (1928-)	Gasoline	Inhibitors	Various inhibitors
1932 (1910-)	Lubes	Sulfur dioxide extraction	Sulfur dioxide
1933 (1928-)	Lubes	Solvent extraction	Nitrobenzene, chlorex, furfural, cresol, phenol
1933 (1930-)	Lubes	Pour-point depressants	Additive
1933 (1930-)	Crude	Corrosion neutralizers	Ammonia, caustic
1933 (1925-)	Lubes	Neutralization	Ammonia
1935 (1928-)	Light oils	Copper sweetening	Copper chloride
1935 (1930-)	Crude	Desalting	Various agents
1935 (1927-)	Lubes	Solvent dewaxing	Methyl ethyl ketone, propane
1935 (1932-)	Lubes	Deasphalting	Propane
1935 (1933-)	Gases	Catalytic polymerization	Phosphoric acid catalyst
1938 (1931-)	Greases	Extreme-pressure lubes	Sulfur, chlorine
1940 (1935-1950)	Naphtha	Clay desulfurization	Bauxite
1941 (1939-)	Gasoline	Mercaptan extraction	Caustic, potassium isobutyrate
1943 (1941-)	Gases	Alkylation for aviation gasoline	Sulfuric acid, hydrofluoric acid
1944 (1943-1948)	Gases	Isomerization	Aluminum chloride
1944 (1941-)	Naphtha	Hydroforming for aromatics	Catalysts
1944 (1938-)	Lubes	Heavy-duty, etc., oils	Additives
1944 (1938-)		Catalytic cracking	Catalysts
1945 (1940-)	Waxes	Solvent deoiling	MEK
1950 (1944-)		Propane decarbonizing	Propane
1950 (1944-)		Solvent decarbonizing	Furfural, sulfur dioxide
1952 (1949-)	Naphtha	Catalytic reforming	Catalysts
1954 (1947-)	Light oils	Hydrodesulfurization	Catalysts
1955 (1953-)	Gases	Alkylation for motor fuels	Sulfuric acid, hydrofluoric acid
1954 (1948-)	Gasoline	Additives	Various additives
1955 (1950-)	Light oils	Additives	Various additives
1956 (1954-)	Gasoline	Inhibitor sweetening	Diamines
1957 (1955-)	Lubes	Urea dewaxing	Urea
1957 (1942-)	Naphtha	Isomerization	Catalysts

TABLE 2—MOST SIGNIFICANT REFINERY CHEMICALS‡

	Approx. 1956 price (ct./lb.)	Per cent by weight (approx.) 1930	1940	1950	1956
Sulfuric acid	1.2	58.5	53.7	57.0	54.0
Clay or bauxite	1.3	10.6	9.4	10.3	8.6
Caustic	4.1	8.5	7.2	7.1	6.5
Soda ash	1.8	0.8	1.0	1.1	1.1
Litharge	22.0	0.4	0.4	(*)	(*)
Compounding agents (greases)	8.0	2.3	1.4	1.2	0.9
Lime	0.5	(*)	1.7	1.6	1.4
Hypochlorite	5.0	(*)	....	....	....
Solvents (lubes)	14.0	....	0.6	0.6	0.6
Additives (lubes)	29.0	....	1.0	4.3	6.0
Cracking catalysts	14.0	....	1.0	3.8	7.8
Ammonia	18.0	....	(*)	(*)	(*)
Copper chloride	45.0	....	(*)	(*)	(*)
MEK	12.0	....	(*)	(*)	0.2
Ethanolamines	....	....	(*)	(*)	(*)
Gasoline dyes, inhibitors and additives	12.0	....	(*)	2.0	5.4
Phosphoric acid catalyst	....	....	(*)	(*)	(*)
Hydrofluoric acid	26.0	....	....	(*)	0.2
Solvents (decarbonizing)	....	....	....	....	(*)
Reforming catalysts	400.0	....	....	....	0.2
Hydrodesulfurization catalysts	....	....	....	....	(*)
Others	....	18.9	22.6	11.0	7.2
Billions pounds per year (approx.)	....	1.93	2.92	4.66	6.40
Average price, cents per pound (1956)	....	1.82	2.28	3.58	5.95
Average price, cents per pound at date†	....	1.19	1.35	2.98	5.95
Price index of refinery chemicals‡	....	18.4	22.65	50.0	100.0

*Next in quantity but insignificant in the total. †Using Bureau of Labor statistics price index for industrial chemicals. ‡Excluding TEL.

types of chemicals used today.

The approximate total amount of chemicals used by the industry can be obtained by the use of the Chemical Consumption Index published each month in Chemical Engineering. One of the components of this index is Refining Chemicals, and this component can be used to indicate the consumption of the refining industry. About 1.93 billion pounds of chemicals were used during 1930, whereas 6.4 billion pounds were used during 1956.

In summary, inflation in prices accounts for some of the increase in chemical costs but changes in the kinds of chemicals are far more significant:

	Price index of industrial chemicals	Refinery chemicals† Cost index	Refinery chemicals† Consumption index
1930	65.6	18.4	30.1
1940	59.2	22.65	45.6
1950	83.3	50.0	72.8
1956*	100.0	100.0	100.0

*6,400,000,000 lb. of chemicals worth 6.15 cents per pound. The 6.15 cents per pound is the result by a complete tabulation of over 106 chemicals whereas the 5.95 cents shown in Table 2 represents only the 13 major types of chemicals. †Excluding tetraethyl lead.

Tetraethyl lead is not included in any of the computations. About 464,000,000 lb. of TEL were used in 1956 and its price is about 60 cents per pound.

The 1956 cost of chemicals (excluding TEL) on a per barrel basis is about 12.8 cents (based on 6.15 cents per pound which is based on complete data rather than the 5.95 cents shown in Table 2).

How much TEL per gallon

How can we decide how much TEL should be used in our gasoline? We seem to use more than other refiners.—S.W.T.

To answer your question properly is impossible without a complete economic study of your particular operations. Refiners who have invested large amounts in processes for the production of high-octane blending stocks use less tetraethyl lead than those who have not made such expenditures.

However, the actual amounts of TEL used as shown in Fig. 1 is of some significance. It somewhat represents the sum total experience of the industry in trying to discover the economical amount of lead to use. The plot (Fig. 1) is simply the average amount of TEL used (regular and premium) during the years 1948-1956. Also at the lower ends of the curves, the relationship for regular-grade gasolines during 1934-1941 are shown with special triangle and square points. Apparently a different set of economic factors governed the blending of premium fuels during 1934-1941 (possibly the higher lead susceptibility of straight-run fuels) because very much more lead (30-90 per cent more) was used for premium fuels.

Finally, the amount of TEL used since 1930 indicates that it has been feasible to raise the clear octane number of the gasoline by about 7-14 units:

	cc. TEL	Rise in res. O.N.
1930 premium	1.8	14.5
1931 premium	1.85	13.5
1933 premium	2.15	13.0
1933 regular	0.75	10.0
1939 regular	1.05	10.5
1939 premium	2.45	12.4
1943 regular	0.85	8.2
1943 premium	2.25	11.4
1945 regular	1.00	9.5
1945 premium	2.15	13.1
1950 premium	2.20	11.7
1950 regular	1.80	11.6
1952 regular	1.73	11.7
1952 premium	2.07	10.0
1954 premium	2.50	8.6
1954 regular	2.12	11.3
1956 regular	2.17	11.6
1956 premium	2.54	7.2

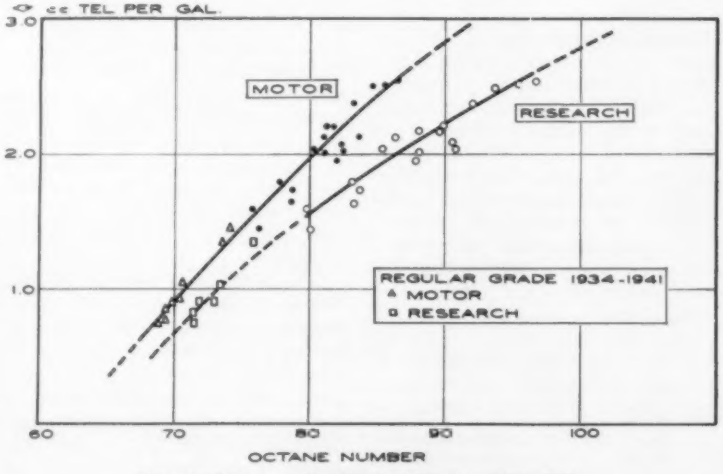

Fig. 1—Octane number-TEL relationship since 1948.

Maintaining Ethanolamine (Part 2)

Elements of
FIELD PROCESSING

Problems in making ethanolamine are solved by careful plant operation

BY J. C. DINGMAN and R. P. MONAGHAN

EXCESSIVE foaming of ethanolamine solutions is a serious problem to plant operators since it causes entrainment of a ethanolamine solution in the gas and results in high cost of chemical makeup. The loss of treating capacity and ability to meet specifications is just as serious.

One cause of foaming is known to be condensation of hydrocarbons in the ethanolamine contactor. This can usually be corrected by operating the contactor in such a way that the inlet-gas temperature is lower than the contactor temperature.

Another cause of foaming is believed to be the introduction of such organic acids[1 2] as naphthenic acid which react with the ethanolamines to form foam-promoting soaps. Pump and valve lubricants can also be a source of surface-active compounds which will contribute to foaming.

Foaming can sometimes be controlled by the addition of antifoam agents such as high-molecular-weight alcohols,[1 2 3] silicones and alkylphenoxyethanols.[3 4] Activated carbon and charcoal filters are also used to remove foam-causing contaminants. This latter treatment is discussed in more detail in a later section of this series.

Thermal decomposition . . . At temperatures commonly used for regeneration of ethanolamine solutions in gas treating, the amines are considered to be thermally stable. It is the belief of some authors[3] that there are very few actual cases which involve thermal decomposition of the aqueous or glycol amine solutions. References have been made[1] to a few cases where thermal decomposition has been noted when conditions of localized overheating existed.

This type of localized overheating is usually associated with the use of direct-fired reboilers, high-temperature oils[5] as a heating medium, or other conditions which result in high skin temperatures in the reboiler. Where excessive regeneration temperatures are used, it is believed by some authors[2] that thermal decomposition of the amine takes place and is then a factor in corrosion. Restoration of monoethanolamine solutions is done by distillation.

In addition to causing a certain amount of thermal decomposition, high temperatures also contribute to the formation of chemical derivatives of ethanolamines such as piperazine, its derivatives, and several diamines.[6 7]

High temperatures will also result in the chemical combination of the ethanolamine with carbon dioxide to form carbamates. These are stable compounds not subject to regeneration by heating or by distillation over soda ash. The ethanolamine may also react chemically with such compounds as carbonyl sulfide, hydrogen cyanide, and carbon disulfide. The reaction products are in some cases regenerable by distillation with soda ash. Substantial losses of active ethanolamine will, however, result from such reactions.

Solution fouling . . . In a closed system such as an amine-treating plant, the circulating solution will invariably become fouled with suspended matter, and with semisolid insoluble material. These contaminants have their origin as decomposition products, as corrosion products, and in many instances, they are introduced to the system by the gas which is being treated. They are obviously undesirable since they will contribute to erosion and to corrosion.

The latter is so because the protective coating of iron sulfide formed on steel equipment will be removed by abrasive action of fines in the circulating solution so as to expose fresh steel surface which reacts to form more iron sulfide. This in turn is removed, and the process continues. These foreign materials are also undesirable because they tend to collect in dead spots in the system and to cause plugging of towers and heat exchangers. Their elimination from the system is discussed under filtration and under solution reclaiming.

Authors are with Jefferson Chemical Co., Houston. From paper presented at California Natural Gasoline Association meeting.

Solution Examination

A number of chemical and physical tests may be run on a sample of ethanolamine solution to determine the extent to which contamination and decomposition have taken place, and to determine to what degree the solution might be corrosive.

Study of the appearance of the solution is a qualitative test to assure reasonable cleanliness. While dark and turbid solutions are often satisfactory from the standpoint of treating gas, they will generally cause trouble in one form or another. Since it is possible to keep the solution clear and nearly colorless, corrective action should be taken when the solution darkens.

In general, the solution should be filtered and redistilled to improve appearance. Where activated charcoal beds are used to remove foam-causing bodies, the solution will generally be made bright and clear at the same time.

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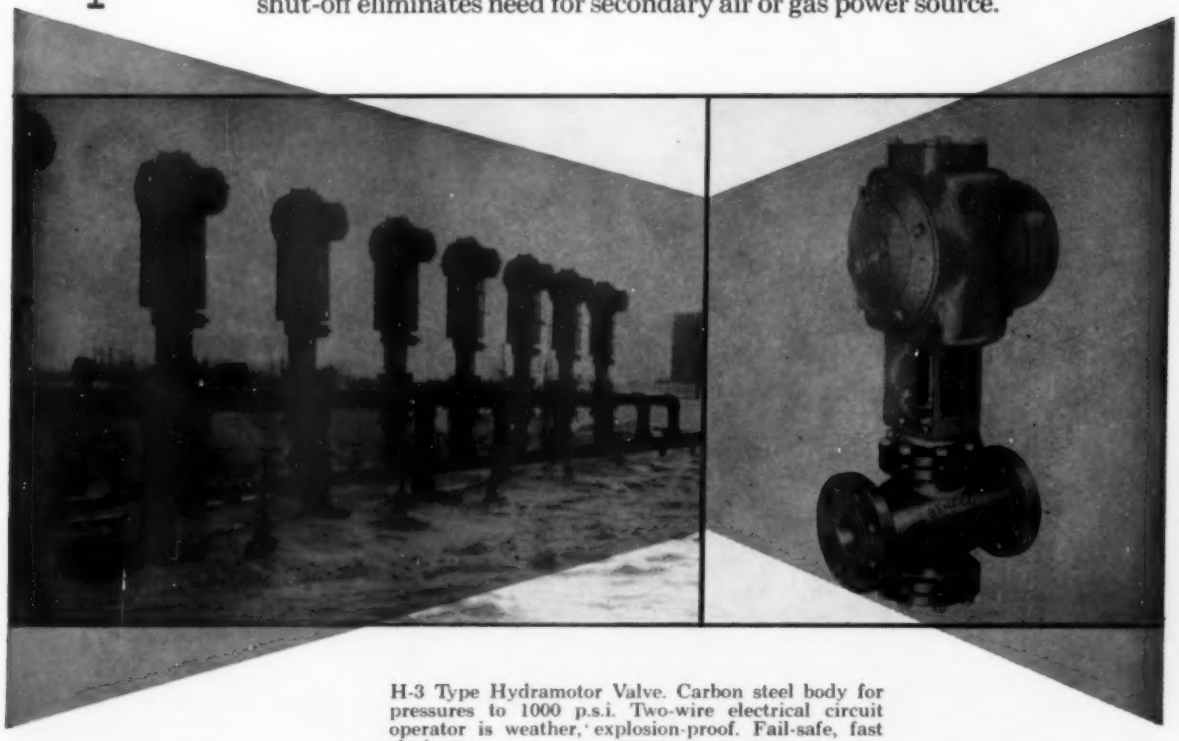

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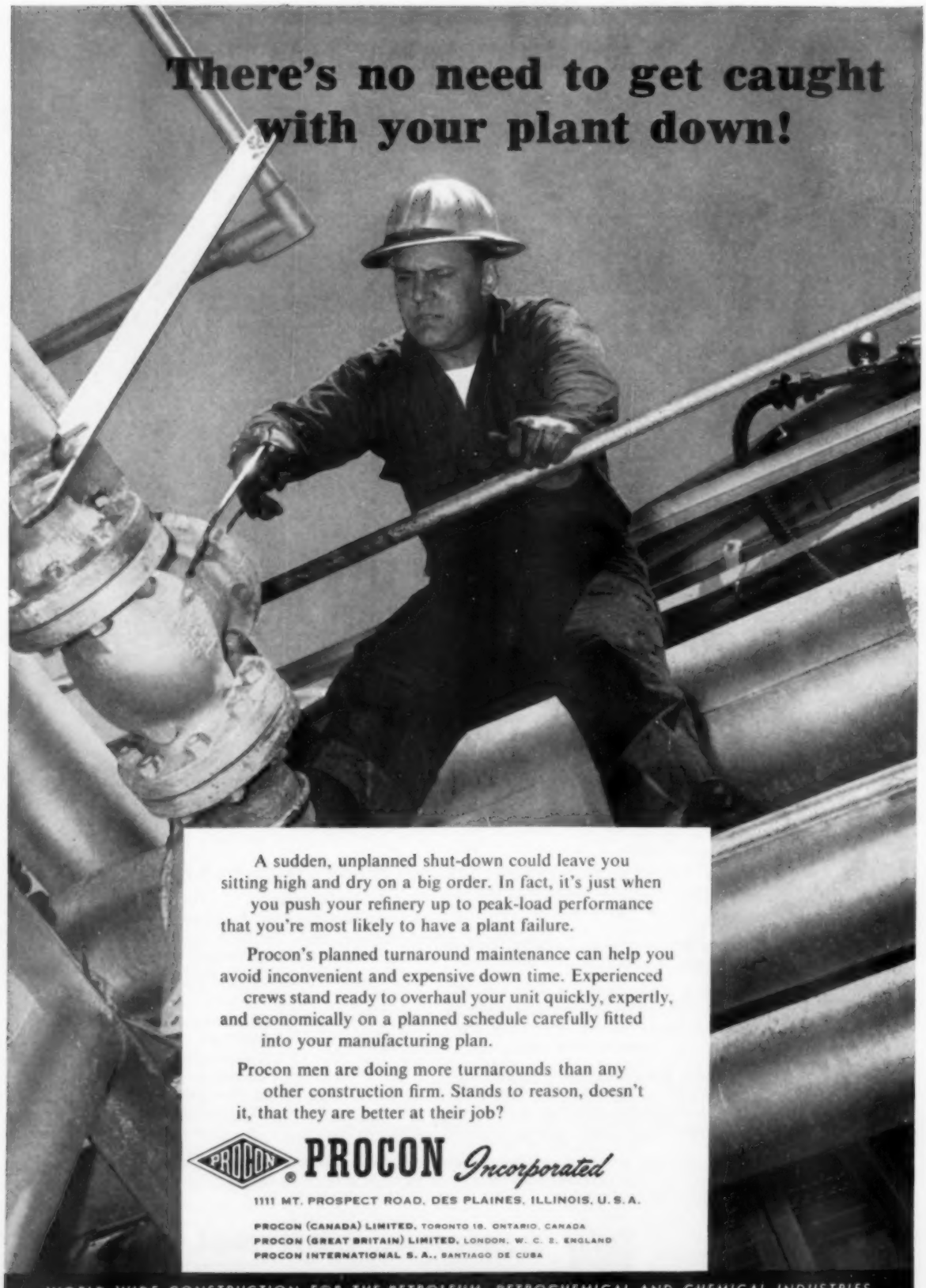

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Use electronic computers to . . .

Calculate two-phase pressure drop

Producing formations frequently yield simultaneously both oil and gas, and the design engineer is confronted with the necessity of figuring the pressure drop which results in the gathering systems.

By **ROBERT L. McINTIRE**
The Datics Corp.

THERE HAVE been several attempts at correlations of the vast quantity of experimental and field data which is available. One of the simplest (and most successful) approaches known to the author is that of Bertuzzi, Tek and Poettmann.[1]

This attack on the problem started with a dimensional analysis and was completed with a statistical evaluation of the correlation. Once theoretical dimensionless groups were formed, the available data were examined by means of a multiple-correlation and regression-analysis procedure.

By this technique, the engineers were able to fit curves in a manner numerically equivalent to drawing smooth curves by graphical means through the experimental data. At the time this work was conducted, the necessary coding was available for the IBM card-programed calculator only. Since that time, however, the many stored-program computers have enjoyed widespread use in this same area.

The final product of this correlation work was a friction-factor chart similar in form and application to the familiar chart used for single-phase flow. A numerical integration must be performed to obtain the pressure drop in the line. Unfortunately, this calculation is especially tedious. Consequently, the computer is called upon again to apply the results in practical cases.

The problem found in practice might be stated as follows: An offshore drilling rig is producing both oil and gas. This product must be piped to the mainland and separated for subsequent handling. The following data characterize known facts about the system:

1. Upstream pressure at the wellhead.
2. Average flowing temperature.
3. Gas-oil ratio.
4. Gravity and viscosity of both gas and oil.
5. Barrels of liquid flowing daily.
6. Gas solubility at the average temperature.
7. Distance from wellhead to stabilizer.

With this information, it is desired to determine the pipe diameter which will be required to deliver the gas and oil at a predetermined pressure.

The method of computation is set forth in the referenced paper.[1] A numerical procedure is following in the computer adaptation to perform the stepwise integration within the computer. Since the equations are very lengthy, they will not be reproduced here, with a single exception. As an illustration, let us examine the manner in which the computer obtains the compressibility of the gas. This expression is given in Equation 1, where T, P, and S are the temperature, pressure and gas gravity. All other symbols are simply curve-fitted constants.

$$Z = 1 + \left[\frac{aT^3}{(bS + c)^3} + \frac{dT^2}{(bS + c)^2} + \frac{eT}{(bS + c)} + f \right] \left[\frac{P}{g + hS} \right] \quad (1)$$

This compressibility calculation was coded in about 60 machine instructions and stored on the magnetic drum as a subroutine within the main machine program. This subroutine, therefore, was executed whenever the main equations called for a Z factor. The design engineer will recognize that this procedure is equivalent to the desk-calculation method of looking up a desired Z factor on a set of charts. In fact, the subroutine could be used to prepare an exhaustive set of tables showing discrete values of compressibility.

A single pass through the routine for an assumed pipe diameter yields the best estimate of the pressure at the stabilizer. Although this computation will be performed on a medium-sized computer in 5 or 10 minutes, the equivalent hand integration would require almost a full engineer day. Repetitive solutions become very practical.

Using the computer, an exhaustive study of all of the factors affecting the accumulation and stabilization of two-phase production can be economically executed. During the period of production, the compositions will change and these changes will reflect differences in the gas-oil ratio and the gas and liquid gravities. The creation of new wells in the same general area may require the installation of new and enlarged gathering systems. The same computer program can be used as a tool in making these varied decisions.

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Test for crude-oil salt content

by following these steps

BY K. G. STOFFER

PREPARE the flame photometer for operation according to the instructions provided by the manufacturer. Calibrate the instrument by using an aqueous solution of 100 p.p.m. Na.

Adjust the sensitivity and slit width settings so that 100 p.p.m. Na gives an arbitrary luminosity of between 40 and 50 per cent of full scale at 589 mμ, oxygen pressure of 9 psig., hydrogen pressure of 2 psig., using a blue-sensitive phototube. Subsequent calibrations, of course, are always made to the same luminosity setting using the 100-r.p.m. Na solution.

Prepare crude-oil samples for analysis by measuring 25 ml. of well-mixed samples into 50-ml. mixing cylinders and diluting them with 25 ml. of benzene. Mix the diluted samples and transfer 2 or 3 ml. of each to separate 5-ml. breakers for analysis. It is best to prepare no more than five or six samples in this manner at one time, because evaporation of the benzene would eventually cause substantial errors in salt values.

After calibration of the instrument with the 100-p.p.m. Na solution, rinse the burner with distilled water, then aspirate the diluted crude-oil samples through the flame, reading the luminosity of each. Readings should be made quickly. Rinse the burner after each reading by aspirating benzene through the flame for an instant.

Read the salt concentrations by referring the Na luminosity of each sample to the calibration curves prepared as described above.

Conclusions: Flame Method

In its application to Arabian crudes the accuracy of this method has been found to be comparable to that obtainable by technicians using extraction procedures. The method should be applicable to crudes in other areas with little or no modification.

- No instrument - maintenance problems peculiar to this application have been encountered. The operation is simple and straightforward.
- Plugging of the medium-bore burner tip has not occurred, although this could become a problem through carelessness in sampling or sample preparation, by allowing gross sand particles or other foreign material to contaminate the sample, and in turn, plug the burner tip.

A larger size tip is available for the Beckman instrument which would possibly be preferred for crudes carrying particles of sand, rust, carbon, or salt crystals too large to pass through the medium tip.

- The method described above has been found to be applicable to Arabian crudes. It determines the salt content of crude oil with satisfactory accuracy and with fewer manipulations, fewer reagents, far less time and therefore less manpower than any method involving aqueous extraction.
- It is reasonable to assume that the method would be applicable to determining the salt content of other crudes.

Author is chemist with Arabian American Oil Co. at Dhahran, Saudi Arabia.

Coming Next . . .

The National Bureau of Standards has developed a reliable method of estimating heat of combustion of jet fuels. This will be presented next in the Refiner's Notebook.

Following this will come a series on laboratory evaluation of waterborne wastes. Waste disposal is becoming an important activity for the refinery engineer and chemist. One item that may be overlooked is the means of laboratory evaluation. This series will deal with

- **Sampling of Wastes**
- **Acidity and Basicity**
- **Chemical Oxygen Demand**
- **Determination of Chloride**
- **Determination of Oily Matter**
- **Test for pH**
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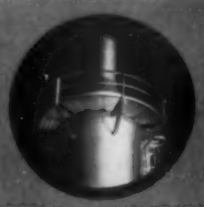


Jobs for the compressor

• Single stage
• Multistage

THE KNOWLEDGE that gas is compressible comes from experience. This experience is first encountered by most people in the use of a tire pump. After the pump is first attached to the tube each stroke injects air into the tube through nearly the full length of the stroke; but later, as the tire pressure increases, nearly the full length of the stroke is used to raise the pressure high enough in the cylinder to go into the tire, and the injection period is only on 1 or 2 in. at the bottom of the stroke.

Also the cylinder grows very hot. This is a natural result. The compression of any gas raises its temperature, and the higher the discharge pressure (with the atmospheric intake), the higher the temperature.

The temperature in a power-driven compressor soon becomes high enough as the discharge pressure increases to make lubrication difficult and cause damage to the machine. To reduce the temperature of compression, the cylinder is either air cooled with radial fins or water jacketed.

Even this is not sufficient for high pressures desired for many uses, so the discharge gas from one compressor is cooled and piped to the intake of a second compressor. Pressure of the cooled gas is then raised without the gas getting too hot at the final desired pressure. This procedure is called stages of compression.

Boosters are compressors for compressing air or gas from a pressure which is considerably above atmospheric to a still higher pressure.

Single-stage compressors are generally used on small units up to 125-lb. pressure with atmospheric intake, although in larger units the second stage is used from 60 lb. and up. As higher pressures are needed, more stages are added. More than three stages are unusual in the oil industry.

It is necessary, as mentioned above, that the gas be cooled after leaving one stage of compression and before entering the next. This cooling of the compressed gas not only avoids dangerous high temperatures but also effects a saving in power. Cooling the gas contracts it, decreasing the bulk or volume to be handled in the next stage of compression.

Multistage compression with intercooling between stages: (1) Reduces final temperature. (2) Reduces horsepower needed to compress. (3) Partially removes entrained moisture. (4) Assists lubrication by condensing (for removal by the scrubbers) the heavier hydrocarbon gasolines which might otherwise wash out lubrication in the cylinder.

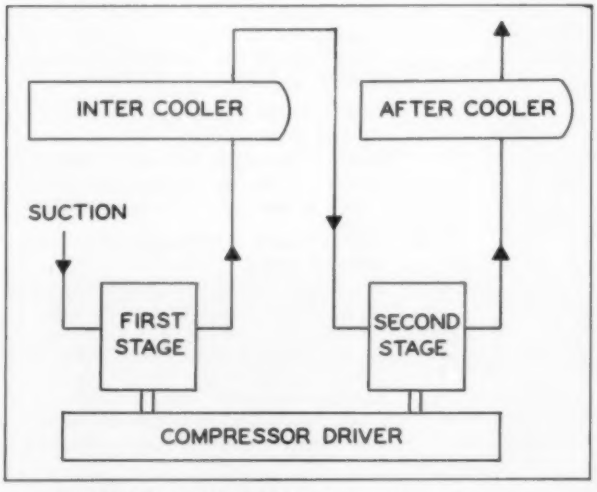
The unit used for cooling the gas is called the inter-cooler. It is desirable in a number of applications to reduce the temperature after leaving the last stage of compression. This unit may be called an aftercooler. Fig. 1 shows two-stage compression with an intercooler and an aftercooler.

Arrangement of cylinders—The requirements desired govern the compressor to be used. There are various pressures and volumes to deal with in the refinery.

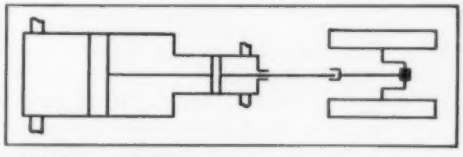
Horizontal or **vertical cylinders** need no explanation as such. They may be direct-driven by engines or belt-driven units. Vertical compressor units in larger capacities are not common. The horizontal units are "single" and "twin." They are either belt or direct-driven with the direct-driven units being most common.

Fig. 2 is a sketch of a single, direct-driven unit, and Fig. 3 is a sketch of a twin, direct-driven unit. Horsepower varies from 50 to 1,500. Compressors are usually double acting, unless they are tandem (See Fig. 2) or for extreme high-pressure service.

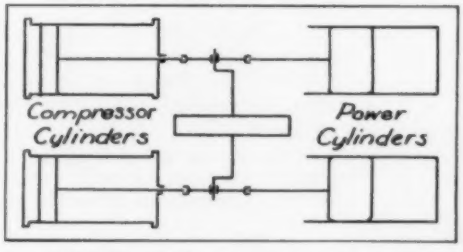
This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso-Standard Oil Co.



TWO-STAGE COMPRESSOR with coolers. Fig. 1.

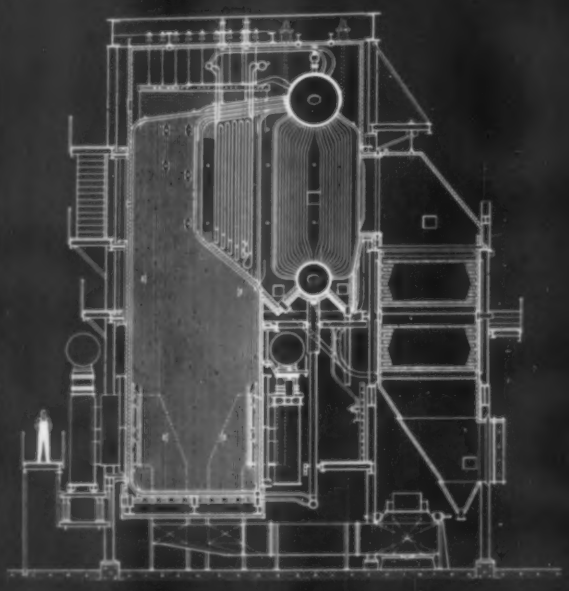


SINGLE direct-driven unit. This horizontal compressor is tandem. Fig. 2.

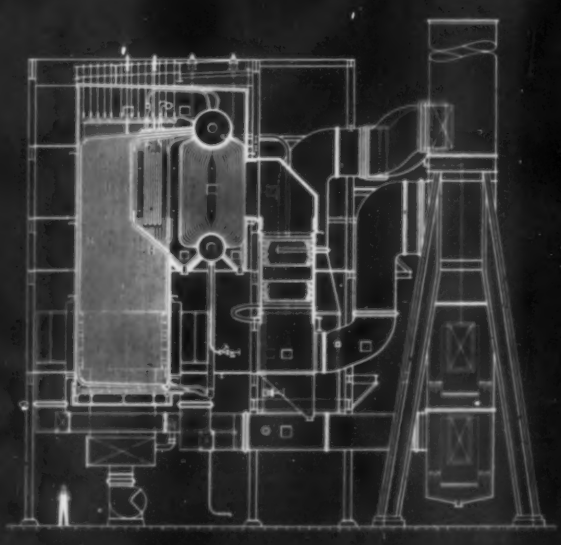


TWIN direct-driven compressor. Fig. 3.

This unit delivers 175,000 lb of 750F steam per hour at 650 psig. In addition to CO gas, it burns pitch, refinery gas and Bunker C oil.



One of two CO boilers for a Texas refinery. Oxygen for combustion is supplied by the exhaust from the gas turbines which drive the regenerator compressors. Steam conditions are 177,000 lb per hr, 625 psig and 700F.



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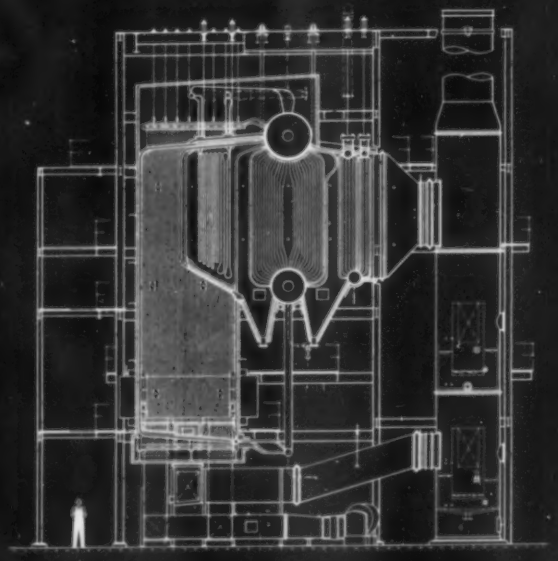
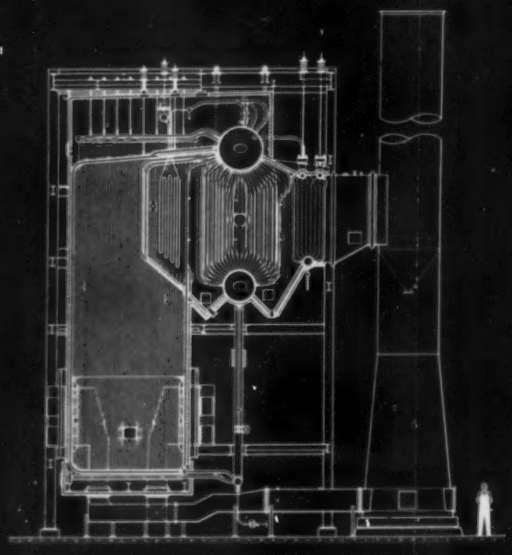
   And the records show that the first CO Boiler placed in service by C-E has been on the line for more than two years without a single unscheduled boiler outage.
2. **YOU'LL WANT OPTIMUM RETURN**
   And CO Boilers by C-E burn regenerator gas efficiently *from minimum to maximum loads.*
3. **YOU'LL WANT LOW POWER CONSUMPTION**
   And CO Boilers by C-E provide minimum air pressure loss and minimum fan horsepower requirements.
4. **YOU'LL WANT LOW MAINTENANCE**
   And double steel, skin cased CO Boilers by C-E contain a minimum of exposed refractory.
5. **YOU'LL WANT THE MOST EFFECTIVE USE OF MATERIALS**
   And C-E makes optimum use of boiler and superheater – gas passage areas and heating surfaces are uniformly distributed across the width of the unit.
6. **YOU'LL WANT ADVANCED DESIGN**
   And C-E Tangential Burners provide complete and positive mixing of air, auxiliary fuel and CO gas, preparing the combination for instantaneous ignition on injection in the furnace.
7. **YOU'LL WANT MAXIMUM CONTROL OF THE COMBUSTION PROCESS**
   And CO Boilers by C-E offer individual, shielded cut-off dampers for each CO gas burner and individual air control for every burner.
8. **YOU'LL WANT A PRODUCT THAT HAS PROVEN ITSELF**
   In terms of general experience, a total of more than 675 tangentially fired C-E boilers have been purchased to date for use with various fuels. As to specific experience with lean fuels, C-E – in addition to its CO Boiler installations in refineries – has installed more than 150 boilers burning blast furnace gas . . . a fuel similar to CO gas with a heating value of about 80 Btu per cubic foot.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

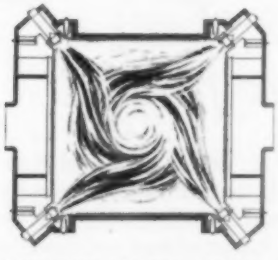
This unit is designed to produce 85,000 lb of 750F steam per hour at 625 psig. Note the C-E seal tank arrangement in the bottom-supported stack.



In its third year of service, this unit provides 100,000 lb of 550F steam per hour at a pressure of 250 psig. It has been off the line only when the cat cracker was removed from service for scheduled maintenance.

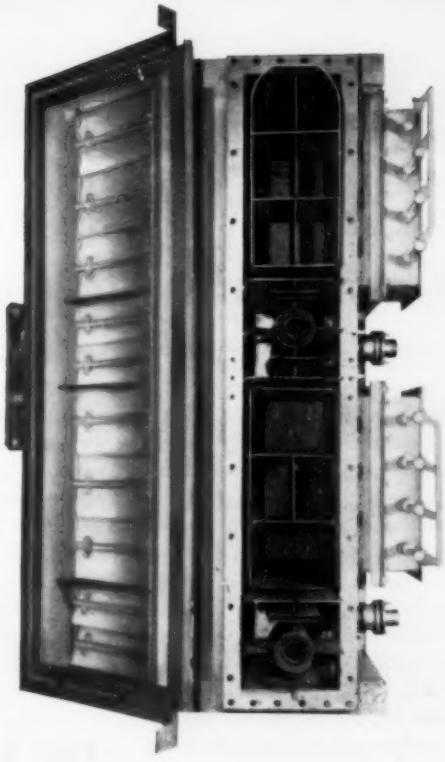


BOILER TO BURN
See C-E



Plan view diagram showing principle of tangential firing in a completely water-cooled furnace.

The C-E Tangential Burner for CO gas. Zone controlled, dampered air inlets are shown at left, dampered CO gas inlets at right. The center panel is a furnace view of the burner. The oil burners in the center and bottom compartments are flanked by flat head burners for natural or refinery gas firing. CO gas is admitted through the other ports.



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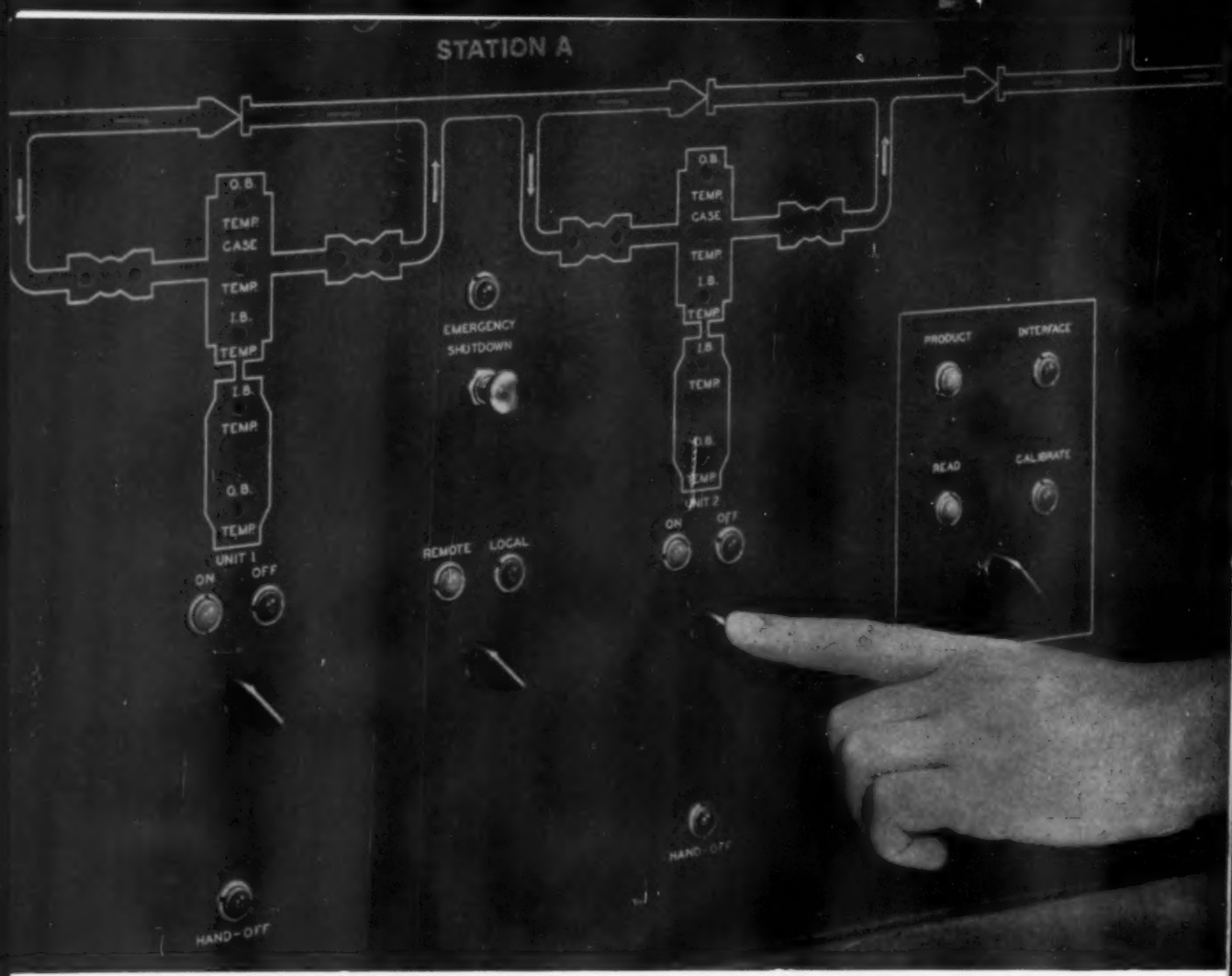

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PIPELINE

CONSTRUCTION REPORT

Who's Laying Line—and Where

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way.

U.S. Crude-Oil Pipelines

- **Belle Fourche Pipeline Co.**
  Project: 30 miles of 6-in. from Donkey Creek pool to Fiddler Creek pool in northeastern Wyo. Will later build a line from Fiddler Creek to connect with Butte Pipe Line Co. near Osage, Wyo.
  Status: Planned.
- **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.)
  Project: Line from lower Delaware Bay to Philadelphia.
  Status: Planned.
  Completion: 1960.
- **Gillette Pipeline, Inc.** and **A. W. Hartwig, Inc.**
  Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
  Status: Has applied for permit from Wyoming Public Service Commission.
- **Great Northern Railway Co.**
  Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and North Dakota, to Clearbrook or St. Paul, Minn.
  Status: Planned.
  Contractor: **Pipe Line Technologists, Inc.** has completed feasibility study.
- **Humble Oil & Refining Co.**
  Project: 90 miles of 16-in. from Hawley to Comyn, Tex.
  Status: Under way.
  Contractor: **O. R. Burden Construction Corp.**
  Completion: Summer 1958.
- **Jayhawk Pipeline Corp.** (Colorado Oil & Gas Corp., National Cooperative Refinery Association)
  Project: 242 miles of 10 and 12-in. from western Meade County, Kansas, to Valley Center near Wichita.
  Status: Will start spring 1958.
  Contractor: **Pipe Line Technologists,** Houston, has engineering contract.
  Completion: August 1958.
- **Offshore Gathering Corp.,** Houston.
  Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)
  Status: Proposed.
- **Oil Field Pipe Line, Inc.**
  Project: 200 miles 8 and 12-in. from near Elkhart, to Ellinwood, Kans.
  Status: Proposed.
- **Portland Pipe Line Corp.** and **Montreal Pipe Line Co., Ltd.**
  Project: 39 miles of 24-in. loops in U. S. and 11 miles in Canada along its 242-mile dual 12 and 18-in. system between Portland, Me., and Montreal, Que.
  Status: To start spring 1958.
- **Shell Oil Co.**
  Project: 17 miles of 3, 4-in. in La. Delta area.
  Status: Under way.
  Contractor: **Brown & Root, Inc.,** W. P. Stanley, supt., office at Buras.
  Completion: March 31, 1958.
- **Shell Pipe Line Corp.**
  Project: 11 miles of 8-in., 3 miles of 10-in., 10 miles of 12-in., 37 miles of 16-in., and 60 miles of 20-in. from Mississippi River Delta area to New Orleans refining area.
  Status: Planned.
  Contractor: **Coates Field Service, Inc.,** has right-of-way acquisition and claims settlement.
  Completion: September 1958.
- **Sinclair Pipeline Co.**
  Project: 150 miles of 20-in. from Teague, Tex., to Houston.
  Status: Under way.
  Contractor: **Lone Star Constructors, Inc.** has 143 miles; **Golightly Construction Corp.** has 6 miles.
  Completion: June 1958.
- **Southern Kansas Pipeline, Inc.**
  Project: 200 miles of 6 to 10-in. in Kans. from southwestern Meade County to 10 miles north of Arkansas City.
  Status: Proposed. Request filed with Kansas Corporation Commission for permit.
- **Texas-New Mexico Pipe Line Co.** (Sinclair, Texas Co., Tidewater, Empire)
  Project: 512 miles of 16-in. from southeast corner of Utah to Jal, N. M.
  Status: Under way.
  Contractor: **Four Way Co., Inc.,** has 150 miles from Aneth field southeast. **Panama, Inc.,** has remaining 362 miles from Cuba to Jal to complete March 1, with two spreads; T. F. Rashell, supt., office at Estrancia, and Eugene Coulter, supt., office at Roswell.
  Completion: May 1958.
- **Toronto Pipeline Co.**
  Project: System to connect fields in Cheyenne, Morrill, and Banner counties, Nebr., to Platte Pipe Line Co.'s 20-in. line from Wyoming to Wood River, Ill., and 13 miles of 4-in. plus field lines to Platt's Redding station.
  Status: Planned.

U.S. Products Pipelines

- **Alaska-Yukon Refiners & Distributors, Ltd.**
  Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on Canol line, to Anchorage.
  Status: Proposed.
  Completion: 1959.
- **American Pipe Line Co.**
  Project: Line from Gulf Coast to New York City. Has ODM approval to amortize 40 per cent of cost with fast writeoff.
  Status: Proposed.
- **Buckeye Pipe Line Co.**
  Project: 70 miles of 8-in. from Wayne to vicinity of Durand, Mich.
  Status: Planned.
  Completion: 1958.
- **Cherokee Pipe Line Co.** (Continental Oil Co., Cities Service Oil Co.)
  Project: 78 miles of 12-in. from Ponca City to Tulsa, Okla.
  Status: To start February 1958.
  Project: Conversion of 400 miles of 10-in. crude line between Glenpool, Okla., and Wood River, Ill.
  Status: Planned.
- **Clark Oil & Refining Co.**
  Project: 15 miles of 8-in. from Blue Island, Ill., to Hammond, Ind., area.

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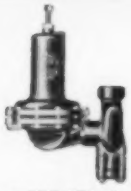
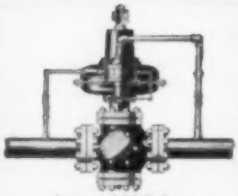
Type 95 Pressure Reducing Valve



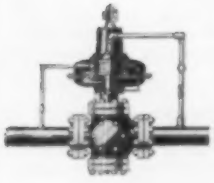
Type 630 "Big Joe" Field Regulator

Series 99 Multi-Purpose Gas Regulator



Series 298T Gas Regulators

Type 655-A Pressure Regulator



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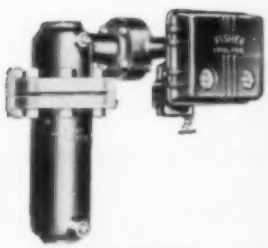

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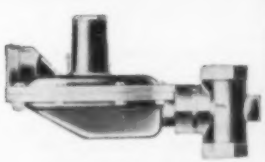
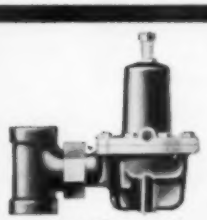
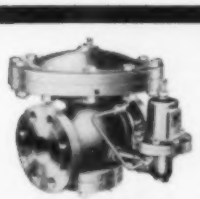


Series S100 and 730 Service Regulators



Series 620 and 621 Farm Tap Regulators



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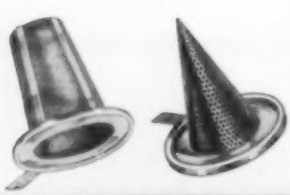

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PIPELINE CONSTRUCTION

Status: Planned.
Completion: Mid-1958.

• **Columbia Gas System, Inc.**
Project: Line from proposed plant near Kenova, W. Va., to proposed plant and storage facilities at Siloam, Ky.
Status: Planned.

• **Conn-Mass Pipe Line, Inc.**
Project: 62 miles of 8-in. and 7 miles of 6-in. from New Haven, Conn., to Springfield, Mass.
Status: Proposed.
Contractor. **Coates Field Service, Inc.,** has right-of-way acquisition and claims settlement.
Project: 88 miles of 8-in. from Boston to Springfield, Mass.
Status: Proposed.
Project: 133 miles of 16-in. from Linden, N. J., to Hartford, Conn.
Status: Proposed.
Project: 38 miles of 6-in. from Waltham to Fitchburg, Mass.
Status: Proposed.

• **El Paso Natural Gas Co.**
Project: 240 miles of 6-in. from Odessa to El, Paso, Tex.
Status: Under way.
Contractor: **McVean & Barlow, Inc.,** E. J. Miller, supt.
Completion: March 1, 1958.

• **Everglades Pipe Line Co.**
Project: 60 miles of 10-in. from Port Everglades, Fla., to Miami's International Airport and terminals south.
Status: Under way.

• **Gulf Refining Co.**
Project: 60 miles of 8-in. propane and natural gasoline line from Barbers Hill to Port Arthur, Tex.
Completion: March 1958.

• **Katy and New York Central Railroads**
Project: 2,000 miles of 10 or 12-in. from Houston through Kansas City, St. Louis, Indianapolis and Cleveland to Syracuse then down to New York City. A branch would go through Chicago to Detroit.
Status: Planned.
Contractor: **Williams Brothers Co.** has feasibility study.

• **Laurel Pipe Line Co.** (Gulf Refining Co., Sinclair Pipe Line Co., The Texas Co.)
Project: 100 miles of 24-in. and 340 miles of line graduating down to 14-in. at the west terminus, from Philadelphia to Cleveland.
Status: To start April 1958.
Contractor: **Pipe Line Maintenance & Construction Co.,** Camp Hill, Pa., has Susquehanna River crossing.
Completion: August 1958.

• **Leonard Refineries, Inc.**
Project: 43 miles of 6-in. from Alma to Lansing, Mich.
Status: Planned.
Contractor: **Welded Construction Co.**
Completion: Spring 1958.

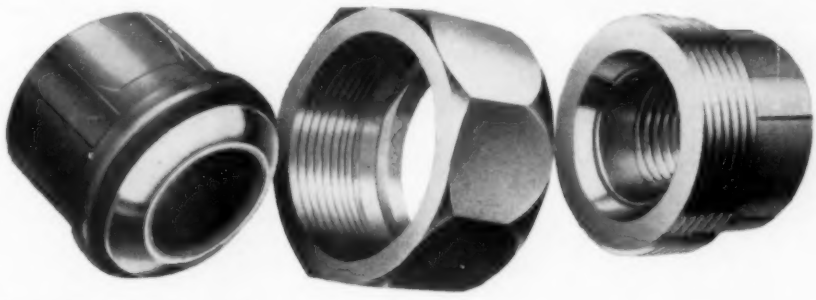
• **Ohio Oil Co.**
Project: 265 miles of 12-in. from Wood River, Ill., to Chicago.
Status: Planned.
Completion: 1958.

• **Underground Storage & Exploration, Inc.**
Project: 393 miles of 12-in. L.P.G. line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.
Status: Proposed.

• **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area.
Status: Proposed.

U.S. Natural-Gas Pipelines

• **American Louisiana Pipe Line Co.**



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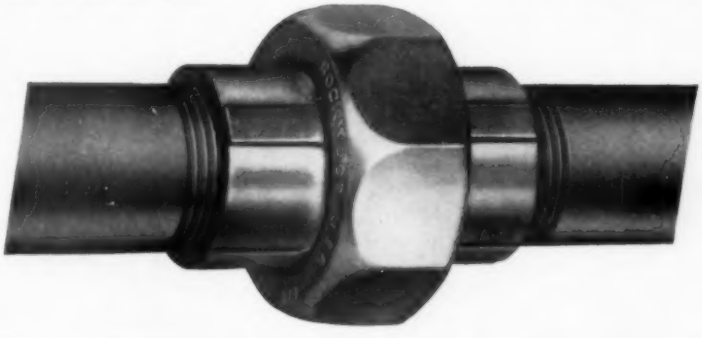
is 150 Brinell harder than .....the female seat.....



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Used for sealing joints on cracking stills and other oil refinery process equipment. Also in process industries and power plants where severe temperatures, pressures and destructive elements are encountered. Style 1000 is strong and resilient. Cushion effect of asbestos filler permits sufficient compression to insure complete, efficient sealing without straining bolts.

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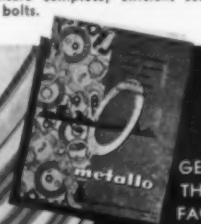

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*No. 2300 is a special composition filler that is for use up to temperatures of +2300° F with suitable metal jackets.

PIPELINE CONSTRUCTION

Project: 7 miles of 16-in. and 5 miles of 12-in. from Second Bayou to Cameron, La.

Status: Under way.

Contractor: **Ford, Bacon & Davis Construction Corp.**

Completion: December 1958.

- **Arkansas Louisiana Gas Co.**

Project: A 300-mile line, plus gathering lines, from Tex.-La. coastal area to northern La., to connect with present system.

Status: Long-range plans.

- **Carnegie Natural Gas Co.**

Project: Two parallel lines to provide coke-oven gas to six Pittsburgh area plants: 9 miles of 55-in. and 4 miles of 43-in. each.

Status: Under way.

Contractor: **Williams Brothers Co.**

Completion: January 1, 1959.

- **Chicago District Pipeline Co.**

Project: 52 miles of 30, 36-in. between Joliet and Chicago, Ill.

Status: Approved by FPC examiners.

Completion: 1958.

- **Cities Service Gas Co.**

Project: 75 miles of 30-in. from Independence to near Welda, Kan.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: February 1958.

Project: 6 miles of 30-in. in Montgomery County, Kansas, and 18 miles of 26-in. in Anderson and Franklin counties, Kansas.

Contractor: **R. H. Fulton & Co.** has the 26-in.

- **Coastal States Gas Producing Co.**

Project: A 20-mile gathering system from the Rock Island area of Colorado County, Tex., to the United Gas Corp. system.

- **Coastal States Gas Producing Co. and Southern Coast Corp.**

Project: 45 miles of 2 to 10-in. in Bee County, Tex. to connect presently shutin fields with Texas Eastern Transmission Corp.'s system.

Status: Planned.

- **Coastal Transmission Corp.**

Project: 562 miles of 12, 20, 22, 24-in. main line and 336 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.

Status: Survey and right-of-way work under way.

Completion: January 1, 1959.

- **Colorado Interstate Gas Co.**

Project: 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pubelo, Colo.; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 24 miles of 22-in. Tex. Panhandle looping.

Status: Approved by FPC examiners.

- **Consolidated Gas Utilities Corp.**

Project: 21 miles of 12-in. and 10 miles of 8-in. at Altus, Okla.

Status: Approved.

- **Eastern Shore Natural Gas Co.**

Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp., in Maryland, across entire length of Delaware to Salisbury.

Status: Approved.

- **El Paso Natural Gas Co.**

Project: 95 miles of 34-in. San Juan main line loops.

Status: Under way. Partially certificated.

Contractor: **R. H. Fulton & Co. has 28 miles. Western Pipeline, Inc.,** has 47 miles. Remainder to be let.

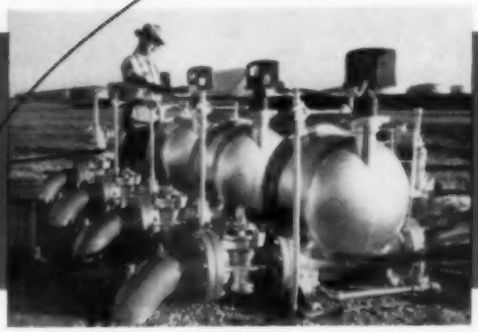
Completion: April 1, 1958.

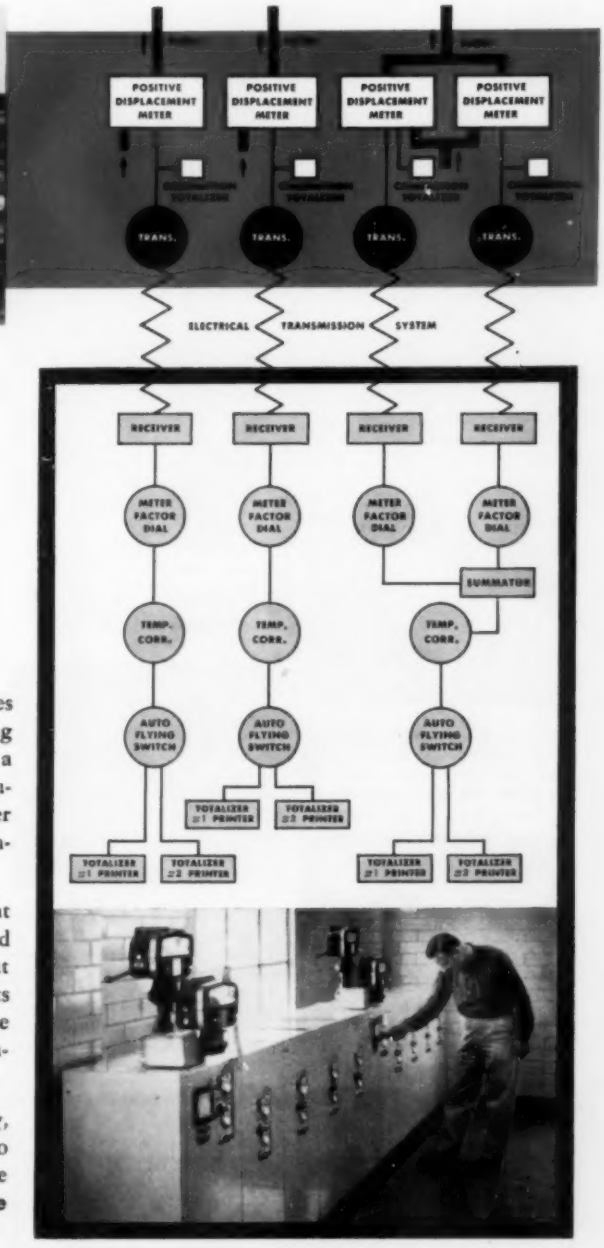
Project: 18 miles of 12-in. between Good Field in Borden Co., and the East Vealmoor gasoline plant in Howard Co., Tex.

Status: Has temporary FPC approval.

Project: 177 miles of 20-in. from Sonora

POSITIVE CONTROL OF MATERIALS IN MOTION B-I-F





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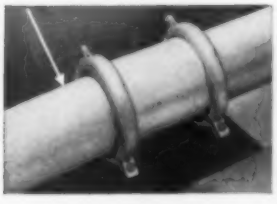

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PIPELINE CONSTRUCTION

plant, Sutton County, to Plains plant, Yoakum County, Texas.

Status: Planned. Filed for FPC permit.

Completion: July 1, 1958.

Project: 193 miles of 30-in. Permian-San Juan main line loops.

Status: Planned. Filed for FPC permit.

Completion: September 1, 1958.

Project: 216 miles of 6 to 34-in. and 533 miles of various size in Ariz., Tex., N. M.

Status: Filed for FPC permit.

Project: 38 miles of various size line to make additional gas available at the McElroy-Wilshire plant near Crane, Tex.

Project: 500 miles of 34-in. from Twin Falls, Idaho to California border near Las Vegas, Nev.

Status: Planned.

Completion: September 1, 1959.

- **Equitable Gas Co.**

Project: 12 miles of storage line in Lewis Co., W. Va.

Status: Approved.

- **Gulf Interstate Gas Co.**

Project: 10 miles of 12-in. supply loop to Erath field, Vermilion Parish, Louisiana, and 9 miles of various size field lines in Acadia and Vermilion parishes, Louisiana.

Status: Approved.

Project: 10 miles of 20-in. loop in Jefferson Davis and Vermilion parishes, Louisiana, and 3 miles of 6-in. loop in Cameron Parish, Louisiana.

Status: Has temporary FPC approval.

Project: 352 miles of 30-in. loop between Louisiana and Leach, Ky.; 54 miles of 24-in. lateral in Louisiana.

Status: Has temporary approval.

Completion: 1959.

- **Houston Texas Gas & Oil Corp.**

Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 139 miles of 18-in. and 101 miles of 20-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's line from McAllen, Tex., to Baton Rouge.

Status: Under way.

Contractor: **Midwestern Constructors** has the 702 miles of 24-in.; **Harbert Construction Corp.** has remainder.

Completion: June 1958.

- **Humble Oil & Refining Co.**

Project: 250 miles of 26 or 30-in. from Southwest Texas area to Houston, plus 200 miles of various size gathering lines.

Status: Planned.

- **Iron Ranges Natural Gas Co.**

Project: 120 miles of 6, 12-in. from Mesabi Iron Range to northern Minn.

Status: Pending FPC approval.

Completion: November 1, 1958.

Project: 63 miles of 12-in. on north shore of Lake Superior.

Status: Pending FPC approval.

Completion: November 1, 1958.

- **Kerr-McGee Oil Industries, Inc.**

Project: 24 miles of 4-in. in Blocks 21, 22, and 32 to connect wells with its Breton Sound production island off the Louisiana coast.

- **Manufacturers Light & Heat Co.**

Project: 3 miles of 12-in. from Wellsville to a point in Saline Township, Ohio; 8 miles of 12-in. in Brook County, W. Va.; 4 miles of 10-in. in Ohio County, W. Va.

Status: Approved.

- **Michigan Consolidated Gas Co.**

Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.**; Floyd Huduall, supt., office at Cadillac.

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

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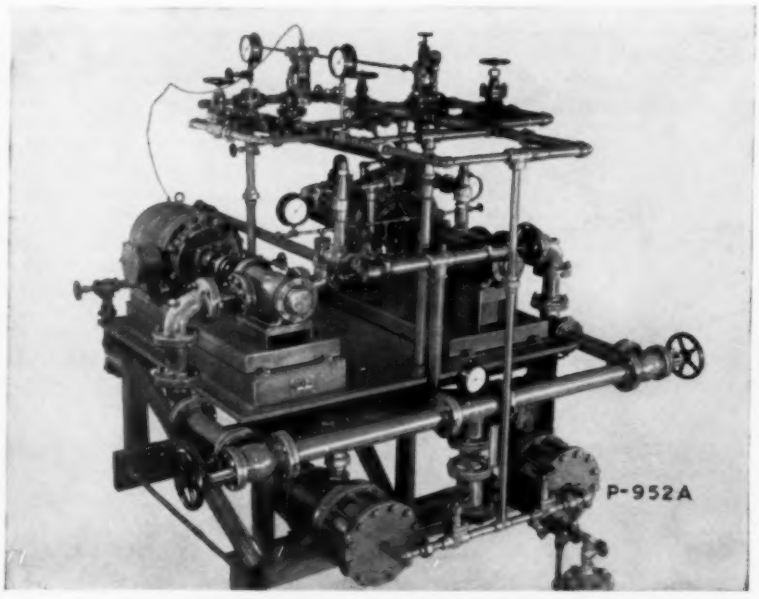

P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact P-ES2H size No. 25 unit.

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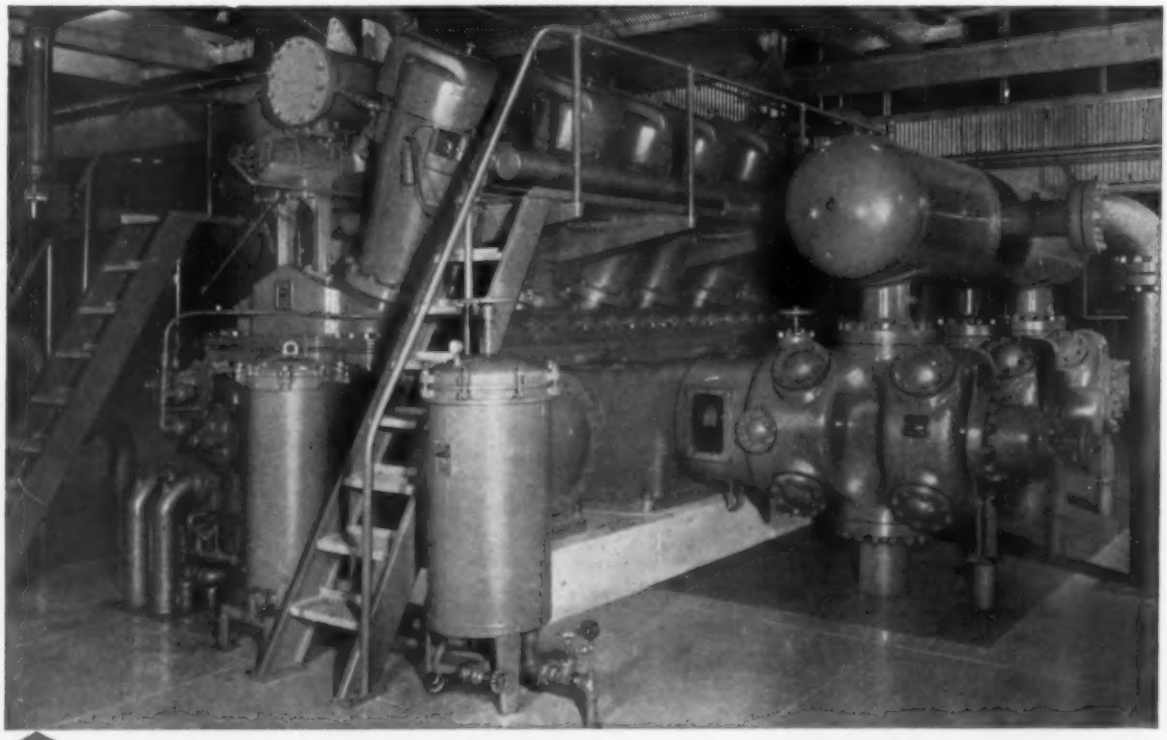
AUTOMATIC CONTROLS



This 1320-hp Ingersoll-Rand KVG gas-engine compressor is in operation at the Hooper Station of Northern Natural Gas Co. The unit is arranged for fully automatic operation as noted below.

CONTROL PHASES PROVIDED

Starting Control

After unloading the compressor end, the engine is started and brought up to a predetermined speed. When minimum engine temperatures are reached, stop valves are operated and the compressor is put on the line.

Normal Speed Control

By remote loading of the engine governor from the control panel, the operator may reset the speed of the engine to meet the demand for gas.

Warning Control

Any abnormal operating temperatures or pressures are reported at the control panel by a signal light and horn.

Emergency Control

Operating temperatures or pressures which reach emergency conditions are reported at the control panel by a light and horn. At the same time the engine is immediately shut down and all components of the system returned to starting position. Lube oil and cooling water circulate for 10 minutes more before being shut off.

Normal Shutdown Control

Through a series of timed events the engine is slowed down, taken off the line and brought to a stop. At this point all components of the system are returned to the starting position except the lube oil and cooling water systems, which circulate for ten minutes more.

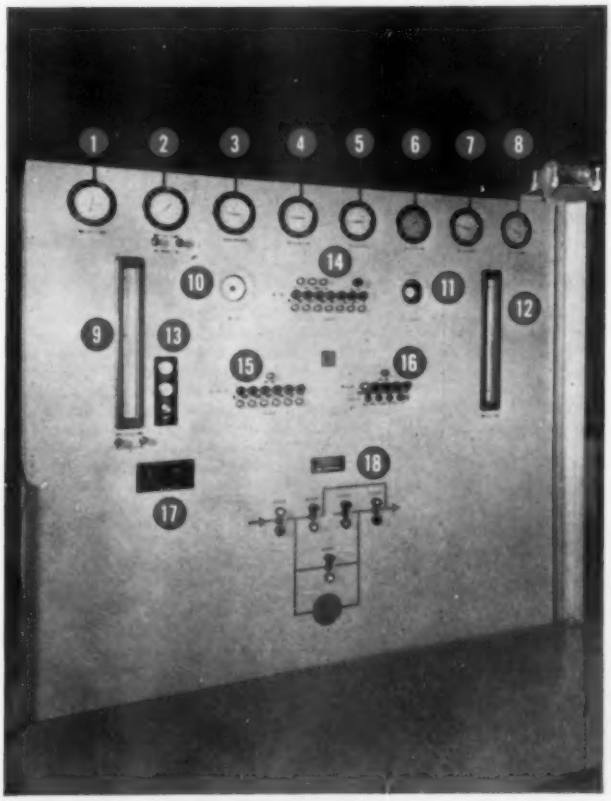
Automatic control panel for I-R gas-engine compressor, designed by Viking Instruments, Inc., in cooperation with Ingersoll-Rand engineers. The panel includes the following instrumentation:

1. Starting Air Pressure
2. Lube Oil Pressure
3. Lube Oil Temperature—entering cooler
4. Lube Oil Temperature—leaving cooler
5. Oil Cooler Water Temperature
6. Jacket Water Pressure
7. Jacket Water Temperature—inlet
8. Jacket Water Temperature—outlet
9. Manifold Depression
10. Tachometer
11. Engine Hours
12. Fuel Gas Pressure
13. Instrument Air, Control Air, Speed Control
14. "Warning" Signals and Controls
15. "Emergency" Signals and Controls
16. "Start-Stop" Signals and Controls
17. Master Control—Power, Stop, Start, Off
18. Compressor Valve Indicators and Controls

make gas-engine compressor

"THINK FOR ITSELF"

1320-hp KVG at Hooper Station of Northern Natural Gas Company features Fully-Automatic Sequence Control



A touch of a button activates the system which puts this big gas-engine compressor into action—another touch shuts it down. And all the time it's running, automatic instruments control the operation and protect it against damage from any cause.

This Ingersoll-Rand 4-cycle, V-angle KVG gas-engine compressor is arranged for completely automatic sequence control operation with a Viking instrument panel. The 1320-hp unit is installed at the Hooper (Nebraska) station of Northern Natural Gas Company.

This unit is not only automatic in operation, but is completely self-protecting. Continuous monitoring and alarm facilities permit immediate diagnosis of any trouble at an early stage, so *preventive* rather than *curative* measures can be taken—thus down-time and costly repairs are minimized. Should any operating conditions exceed safe limits, the machine is automatically shut down before any damage can be done.

On normal shutdown, the engine is slowed, taken off the line, idled for a minute at no load, and then brought to a stop. After either normal or emergency shutdown, lubricating oil and cooling water are circulated for ten minutes.

Ingersoll-Rand 4-cycle V-angle engine-compressors are ideal for automated and remote-control installations, due to inherently greater operating *stability* through a wide range of speeds and loads. Ingersoll-Rand has supplied millions of horsepower of heavy-duty compressors for every possible service, and builds many types of other equipment, in addition to compressors, for the pipeline industry. Call your I-R representative now for more information.

Only compressors have CHANNEL VALVES

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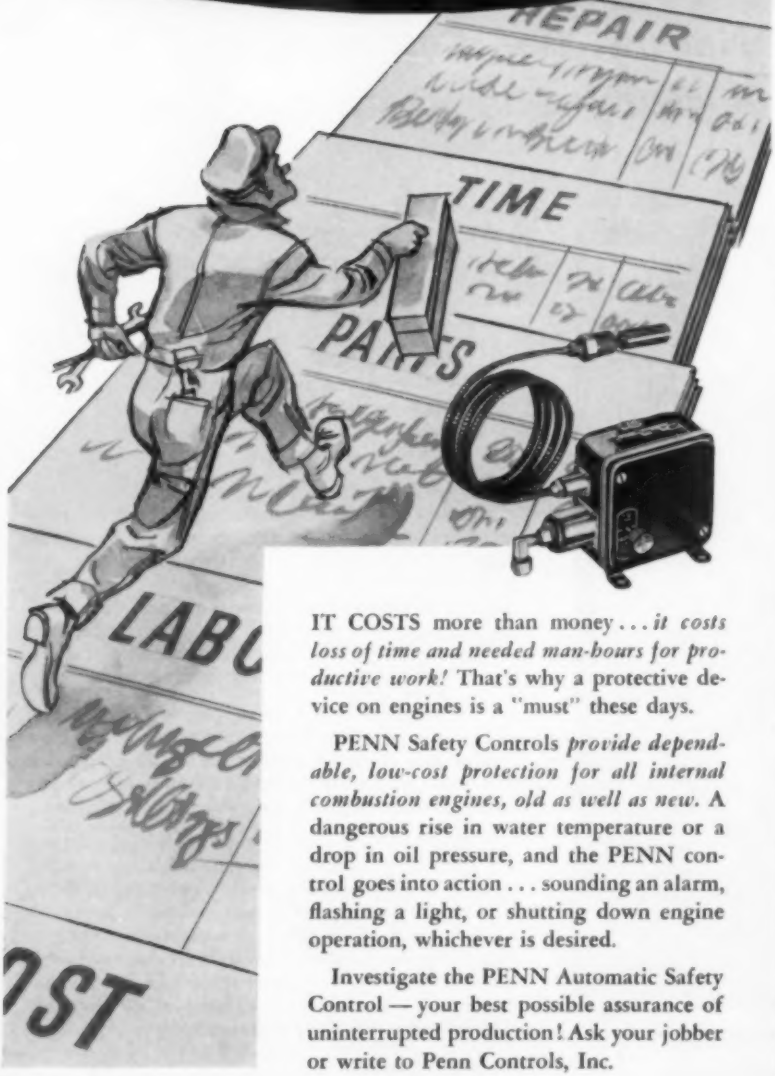

IT COSTS more than money . . . *it costs loss of time and needed man-hours for productive work!* That's why a protective device on engines is a "must" these days.

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AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

PIPELINE CONSTRUCTION

Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.,** jointly with **H. L. Gentry Construction,** Frank Morris, superintendent, office at Hart, Mich.

• **Michigan Gas Storage Co.**
Project: 40 miles of 12-in. and 12 miles of gathering lines from Overisal field in Allegan County to Kalamazoo, Mich.
Status: Planned.
Contractor: **Bechtel Corp.**

• **Michigan Wisconsin Pipe Line Co.**
Project: 33 miles of 4, 6-in., 2 miles of 12-in., 4 miles of 10-in., and 7 miles of 8-in. gathering lines in LaVerne Field, Harper County, Okla.
Status: Planned. Pending FPC approval.
Completion: October 1, 1958.
Project: 56 miles of 20-in. extension of LaVerne line, Harper County, Okla.
Status: Planned. Pending FPC approval.
Completion: October 1, 1958.
Project: 25 miles of 12-in. and 21 miles of 24-in. loops in Wis. and Mich.
Status: Planned. Pending FPC approval.
Completion: October 1, 1958.

• **Midwestern Gas Transmission Co.**
Project: Line from Portland, Tenn., to Minnesota-Canada border near Emerson, Man.: 670 miles of 24-in., 218 miles of 20-in, 371 miles of 16-in., 115 miles of 12-in., 70 miles of 10-in., 179 miles of 8-in., 147 miles of 6-in., 174 miles of 4-in., 106 miles of 3-in.
Status: Pending FPC approval.

• **Mookl Chemical & Gas Corp.** and **Missouri Transmission Corp.**
Project: 425 miles of 16-in. from Pottawatomie County, Okla., to St. Louis. Mookl, 1341 S. Boston, Tulsa, will build Okla. section. Missouri Transmission, Springfield, Mo., will build the Mo. section.
Status: Initial FPC filing rejected. Will refile.

• **Natural Gas Pipeline Co. of America**
Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and 91 miles of 30-in. loops along parts of its main line.
Status: Approved by FPC examiner.
Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joilet, Ill., along existing system.
Status: Pending FPC approval.
Completion: 1959.

• **New York State Natural Gas Corp.**
Project: Will replace 12 miles of 20-in. with 30-in. and 13 miles of 12-in. with 20-in. in Pa.
Status: Planned.

• **North Carolina Natural Gas Corp.**
Project: 630 miles of 2 to 16-in. from near Mooresville, eastwardly across N. C.
Status: Under way.
Completion: Spring 1958.

• **Northern Natural Gas Co.**
Project: 23 miles of 24-in. loops in Nebr. and Iowa; 43 miles of 30-in. loops in Kans., Nebr., and Iowa; 169 miles of 20-in. from Farmington, Minn., to Superior, Wis.; 44 miles of 16-in. in Duluth-Superior-Iron Ranges area.
Status: Pending FPC approval.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Proposed.
Project: 1,090 miles of 2 to 16-in. branch lines to serve communities in Minn., Iowa, S. D., Nebr., Wis.

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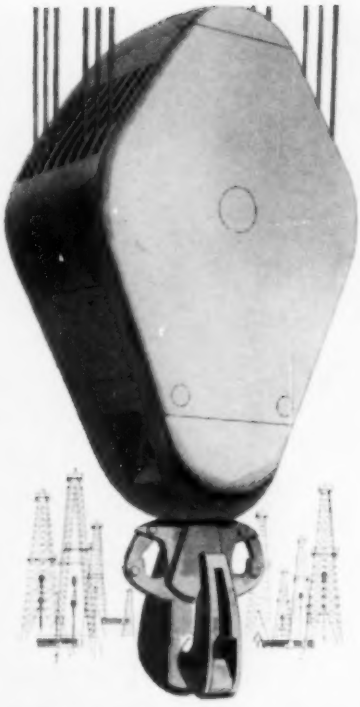

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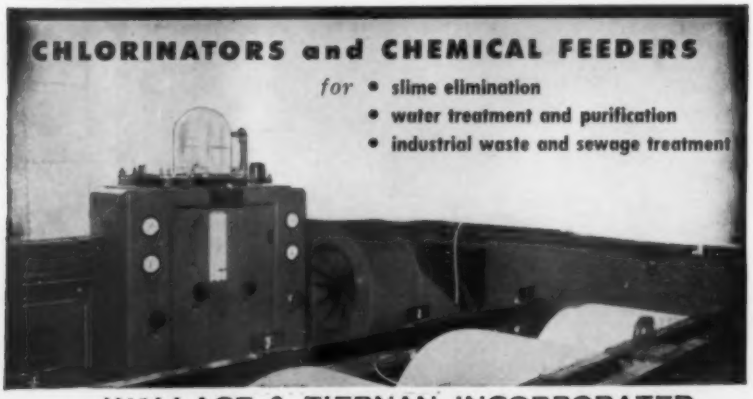
- slime elimination
- water treatment and purification
- industrial waste and sewage treatment



WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

CD-41

PIPELINE CONSTRUCTION

Status: Filed with FPC March 18, 1957.
Project: 28 miles of 30-in. loop in Tex. and Kans.
Status: Has temporary approval.
Contractor: **R. H. Fulton & Co.**
Completion: Late February 1958.

- **Northern Utilities Co.**

Project: 35 miles of 16-in. in Fremont-Natrona County, Wyoming, area; 8 miles of 12-in. around Casper; 6 miles of 8-in. from Sand Draw gas field to Beaver Creek field; 12 miles of 6-in. from Beaver Creek field to the system servicing the Riverton-Lander area.
Status: Planned.

- **Offshore Gathering Corp.**

Project: 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

- **Olin Gas Transmission Corp.**

Project: Mississippi River 3 and 8-in. crossing near White Castle, La.
Status: Under way.
Contractor: **Houston Contracting Co.**, A. J. Slovack and R. E. Thornton, supts., office at White Castle.

- **Pacific Gas & Electric Co.**

Project: 138 miles of 34-in. looping of the Topock-Milpitas line.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: February 1958.
Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 8-in. from Corning to Eureka, Calif.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.** and **Alex Robertson Co.**
Completion: June 1958.

- **Pacific Lighting Gas Supply Co.**

Project: 83 miles of 34-in. from North Coles Levee to Newhall, Calif.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: July 1, 1958.

- **Pacific Northwest Pipeline Corp.**

Project: 40-mile line from Ute Trail gas fields in northeastern Utah to its main line in western Colorado.
Status: Planned to start spring 1958.

- **Pennsylvania Gas Co.**

Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pa., 30 miles of branch lines, several small distribution lines.
Status: Has FPC permit.

- **Permian Basin Pipeline Co.**

Project: 29 miles of 10-in. gathering lines from Crane and Pecos counties to McCamey, Tex.
Status: Under way.
Contractor: **Lone Star Constructors, Inc.**

- **Piedmont Gas Co.**

Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.
Status: Has FPC approval.

- **Seaboard Oil Co.**

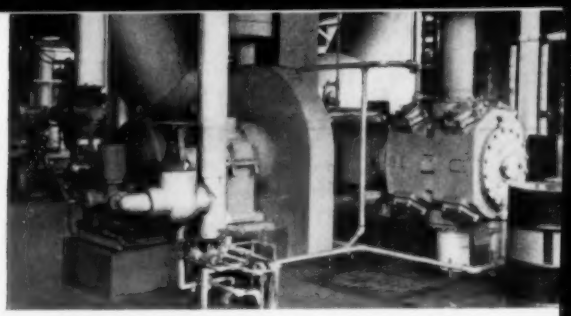
Project: 6 miles of 10-in. in Vermilion and Lafayette parishes.
Status: Has FPC examiner's approval.

- **Shell Oil Co.**

Project: 9 miles of 6-in. from Lake Pontchartrain to Norco, La.
Status: Planned.

- **Southern Natural Gas Co.**

Project: 335 miles of 4 to 26-in. in southern La.
Status: Pending FPC approval.
Completion: December 1, 1958.
Project: 45 miles of 6 to 10-in. in southern La.



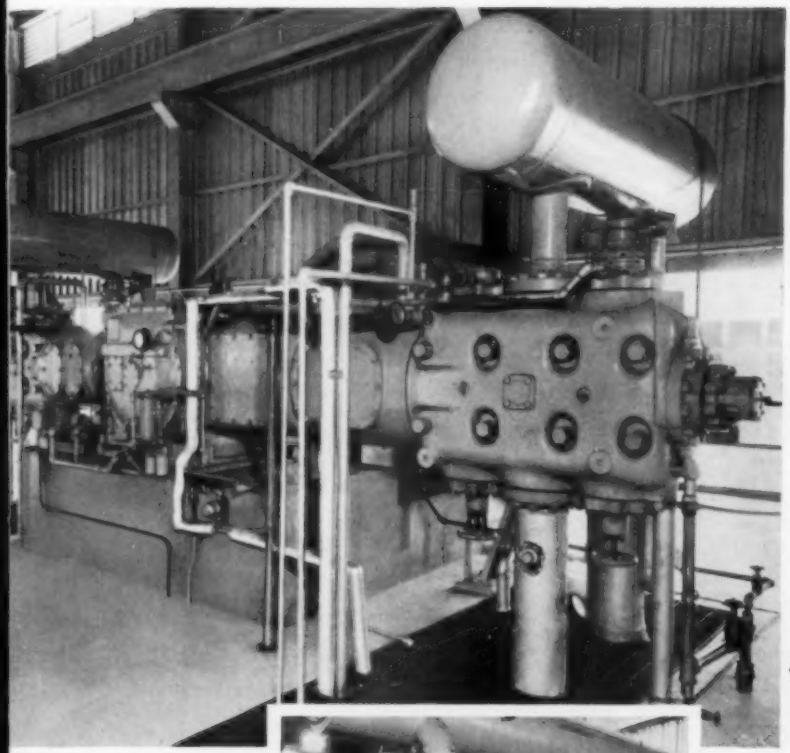
1 This 2-cylinder FM compressor, steam turbine driven, supplies aeriation air for this new Tidewater installation.

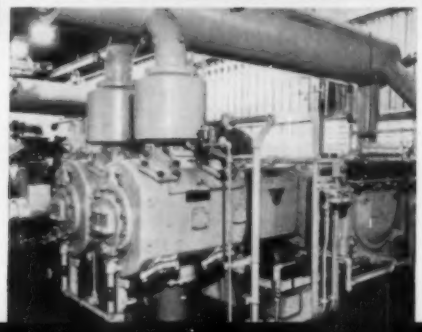
2 To maintain absolute purity in hydrogen compression, this compact motor-driven FM is equipped with non-lubricated cylinders.

3 Handling industrial air requirements for Tidewater's Delaware refinery . . . three 4-cylinder Cooper-Bessemer compressors—one synchronous driven and two steam turbine driven.

Cooper-Bessemer FM Compressors

. . . for simplicity and efficiency in meeting multiple requirements in the world's largest refinery ever to be built at one time





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PIPELINE CONSTRUCTION

Status: Pending FPC approval.
Completion: December 1, 1958.
Project: 25 miles of 6 to 20-in. in southern La.
Status: Pending FPC approval.
Completion: December 1, 1958.

• **Tennessee Gas Transmission Co.**
Project: 556 miles of 30-in. from Mississippi Delta area south of New Orleans to Portland, Tenn.
Status: Has temporary FPC approval.
Project: 76 miles of 24-in. from Coudersport, Pa., to Hamburg, N. Y.
Status: Has temporary FPC approval.
Project: 163 miles of 30-in. and 101 miles of 26-in. from Portland, Tenn., to near Lancaster, Ky.; from Winchester, Ky., to Morehead, Ky.; from Catlettsburg, Ky., toward Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from Morehead, Ky., to Catlettsburg, Ky.
Status: Has Temporary FPC approval.
Project: 10 miles of 12-in. extension of system in Gulf of Mexico to terminate at CATC Group's Block 59 field.
Status: Under study.

• **Texas Eastern Transmission Corp.**
Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.
Status: Has FPC approval.
Project: 140 miles of 30-in. between Kosciusko, Miss., and Uniontown, Pa., 105 miles of 30-in. between Opelousas, La., and Kosciusko, 22 miles of 14-in. supply line in La.
Status: Pending FPC approval.

• **Transcontinental Gas Pipe Line Corp.**
Project: 202 miles of 36-in. and 132 miles of 30-in. main line loop; 164 miles of 24-in. to connect storage in Pa.; 202 miles of 10 to 20-in. gathering lines in southeast La.; 48 miles of 10 to 20-in. to tap gas off Tex.
Status: Pending FPC approval.
Project: 57 miles of 36-in. main line loop.
Status: Pending FPC approval. Planned for 1959.
Project: 87 miles of 24-in. laterals, plus small gathering lines connecting seven Louisiana fields with the New Orleans area.
Status: Pending FPC approval.

• **Transwestern Pipe Line Co.** (Warren Petroleum, Monterey Oil Co.; J. R. Butler).
Project: A line from W. Tex. area to Calif. border.
Status: Proposed.

• **United Gas Pipe Line Co.**
Project: 18 miles of 12-in. from Lirette-Mobile line in Jackson County, south to Bayou Casottee industrial area east of Pascagoula, Miss.
Status: Approved.
Project: 202 miles of 30-in. loop from southeast Louisiana, to Mobile, Ala.
Status: Pending FPC approval.

Canadian Crude-Oil Pipelines

• **Act Oils, Ltd.**
Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Bella Coola, B. C.
Status: Request has been made for permit from the B. C. government.

• **B-A Alberta Pipe Line, Ltd.**
Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

• **Bituminous Oil Pipeline Co.** (Royalite Oil Co. and Can-Amera Oilsands Development, Ltd.)
Project: 250-mile line from Athabasca oil sands in northeastern Alta., to Edmonton.
Status: Long-range plans.
Completion: 1960.

• **East Coast Transmission Co.** (Pacific Petroleums, Ltd., Home Oil, Ltd., Canadian Homestead Oil, Ltd., Merrill Petroleums, Ltd.)
Project: Line from Alberta to Montreal.
Status: Proposed.

• **Gibson Petroleum Co., Ltd.**
Project: 25 miles of line from Willesden Green field to near Rimbley, Alta.
Status: Has Alberta Government approval.

• **Interprovincial Pipe Line Co.**
Project: 82 miles of 24-in. loops in Alta. and Sask.
Status: Planned.

• **Westcoast Transmission Co., Ltd.**
Project: Line to parallel its 650-mile, 30-in. gas line from Peace River to Vancouver, B. C.
Status: Under study.

• **Westspur Pipe Line Co.**
Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields; 34 miles of 4, 6, 8-in. gathering lines.
Status: Has requested permit from Board of Transport Commissioners.
Contractor: **Majestic Contractors, Ltd.**, Jeff Minter, supt., office in Estevan, Sask.
Completion: No date set.

Canadian Products Pipelines

• **Hydrocarbons Pipeline Co.**
Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.
Status: Has permit from Parliament of Canada. Seeking approval by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board.
Construction consultants: **Dutton-Williams Brothers, Ltd.**, and **A. D. Little Co.**

Canadian Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**
Project: 637 miles of 34 to 16-in. gathering lines in Alberta.
Status: Under way.
Contractor: **Dutton - Williams Brothers, Ltd.**, has preliminary studies, design and management - engineering. **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.**, has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.**, has completed 17 miles of 34-in. west from Burstall, Sask., to near Cavendish, Alta., and 100 miles of 18-in. north to Bindless and Provost fields.

• **Alberta & Southern Transmission Co., Ltd.**
Project: 1,300 miles of 36-in. from Alberta to San Francisco area plus 47 miles of gathering lines.
Status: Planned.
Completion: 1960.

• **Canadian Western Natural Gas Co., Ltd.**
Project: 58 miles of 16-in. from Carbon field to Calgary, Alta.
Status: Proposed. Pending approval of Alberta Oil and Gas Conservation Board.

• **Northern Ontario Pipe Line Crown Corp.**
Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line; will be leased to Trans-Canada Pipe Line Co. with option to buy.) 360 miles from Port Arthur to Kapuskasing remains to be laid in 1958.
Status: Under way.
Contractor: **Nelen, Ltd.; Majestic Contractors, Ltd.; B. C. River Construction, Ltd.**, has 91 miles from Longlac to Hurst, E. L. Maggard, supt., office at Longlac; **Mannix, Ltd.; and Morrison Shivers, Ltd.**
Completion: November 1958.

• **Northwestern Utilities, Ltd.**
Project: 72 miles of 16-in. from Pembina field to Edmonton, Alta.
Status: Approved. Planned for 1958.
Completion: 1958.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 491 miles of 30-in. from Kapuskasing to Toronto.
Contractors: Starting at Kapuskasing and going toward Toronto, **Grayco Contractors, Inc.**, has 82 miles; **Majestic Contractors, Ltd.**, has 83 miles; **Dutton-Williams Brothers, Ltd.**, has 57 miles; **Canadian Bechtel, Ltd.**, has 47 miles from Rib Lake to Tilden Lake, H. F. (Hank) Mogg, general supt., office at Timagami; **Morrison-Shivers, Ltd.**, has 62 miles; **H. C. Price Co.** and **Poole Construction Co.** has 63 miles; **Oklahoma Pipe Line Constructors** has 92 miles.
Completion: October 1, 1958.

• **Westcoast Transmission Co., Ltd.**
Project: 42 miles of 20-in. and 100 miles of 30 in. from Savanna Creek area, Alta., to Canadian-Idaho border.
Status: Planned.
Completion: November 1, 1958.
Project: Looping of present system to double capacity.
Status: Planned.

Foreign Crude-Oil Pipelines

• **Arabian American Oil Co.**
Project: 9 miles of 32-in. loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1960.
Project: 17 miles of 32-in. extension of loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1961.
Project: 9 miles of 30-in. extension of loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1960.
Project: 12 miles of 30-in. extension of loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1961.
Project: 54 miles of 30-in. loop of Safaniya-Ras Tanura line.
Status: Planned.
Completion: January 1959.
Project: 63 miles of 30 and 32-in. from Khursaniyah to Ras Tanura.
Status: Planned.
Completion: January 1960.

• **Assam Oil Co.**
Project: 600 miles of 20-in. from Nahorkatiya field in Upper Assam to Barauni, India, to connect with Burmah Oil Co.'s proposed 250-mile line from Barauni to Calcutta.
Status: Survey of possible routes under way.
Contractor: **Pipe Line Engineering Co.** is making survey.

• **Bolivia-Paraguay.**
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned .
Contractor: **Five Lilles,** a French Combine.

• **Burmah Oil Co., Ltd.**
Project: 250 miles of 20-in. from Barauni to Calcutta, India, extending Assam Oil Co.'s proposed line.
Status: Survey under way.
Contractor: **Collins Construction Co.** is surveying locations for some 40 river crossings.

• **Caltex**
Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles to Minas field later.
Status: Under way.
Contractor: **Bechtel Corp.**

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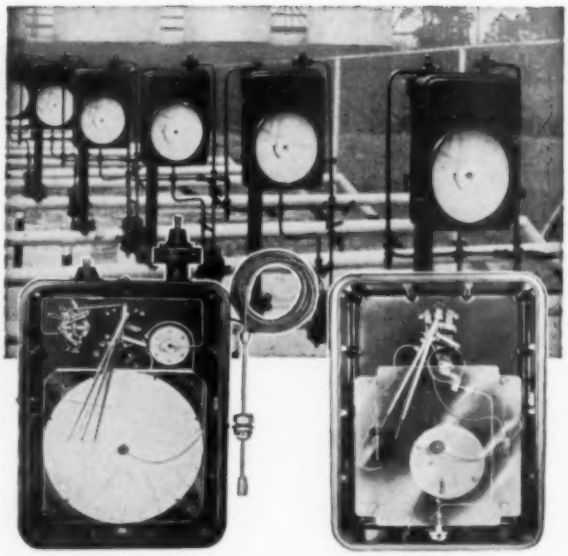

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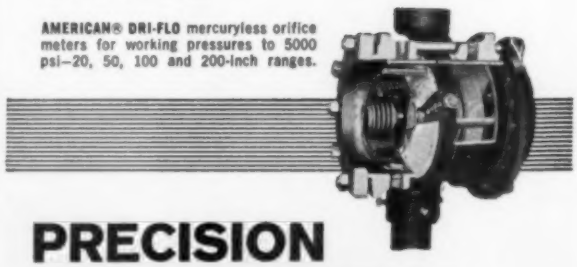

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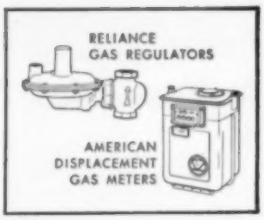

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PIPELINE CONSTRUCTION

Completion: May 1958.

- **Cia. Shell de Venezuela**

Project: 34 miles of 16-in. from Boscan to site of a planned terminal at Puerto Miranda Venezuela.

Status: Planned.

Contractor: **Williams Brothers Sudamericano, Ltd.**

- **Colombian Petroleum Co.**

Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.

Status: Under way.

- **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**

Project: 450 miles of 16-in. from Edjele field in southeastern Algeria to a Mediterranean port on the Libyan coast.

Status: Pipe has been ordered.

- **Creole Petroleum Corp.**

Project: 100 miles of 30-in. from Temblador field to Caripito in Venezuela.

Status:Under way.

Contractor: **Pipe Line Engineering Co. and Oklahoma Pipe Line Constructors,** R. J. O'Connell, supt., office at Maturin.

Completion: April 30, 1958.

- **Elburz Oil Corp.**

Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.

Status: Planned.

- **Iranian Oil Participants, Ltd.**

Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bandar Mashur line.

Status: Planned.

Project: 50 miles of 26, 28-in. from Gach Saran field to new terminal at Kharg Island in the Persian Gulf.

Status: Planned.

Contractor: A joint venture of **Raymond Concrete Pile Co.** and **Williams Brothers Co.** of Tulsa; **Richard Costain, Ltd.,** and **John Brown, Ltd.,** of Britain; **Werkspoor & Bredoro** of The Netherlands.

- **Iraq Petroleum Co.**

Project: About 600 miles of up to 40-in. from Kirkuk field through Iraq to Turkish port of Iskenderun on the Mediterranean.

Status: Proposed. Survey completed.

- **Mene Grande Oil Co.**

Project: 97 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.

Status: Under way.

Contractor: **Fulghum Contracting Corp.** has 22 miles between Oficina and Anaco. **Williams Brothers Co.** has remainder.

Completion: First quarter 1958.

Project: 45 miles of 24-in. from Oficina to Melones, Venezuela.

Status: Planned.

Completion: First quarter 1958.

- **Middle East Pipeline**

Project: 1,500 miles of 38 and 40-in. line from Persian Gulf to Mediterranean at Iskenderun, Turkey.

Status: Proposed.

- **North-West Oil Pipeline Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)

Project: 230 miles of 28-in. from refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.

Status: Work to start early 1958.

Contractor: **W. M. Lyles** in joint venture with two German steel firms.

Completion: November 1958.

- **Royal Dutch-Shell**

Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, Netherlands, and Belgium. Main trunk to be 30-in.

Status: Company is considering project together with several other companies.

- **SOPEG** (Cie. Francaise de Petrole (Algerie) and Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie)

Project: 300 miles of 24-in. from Hassi Messaoud field in the Algerian Desert to Bougie on the Mediterranean Coast.

Status: To start fall 1958.

Contractor: **Entrepose Co.** jointly with **Ste. Parisienne pour Industrie Electrique.**

Completion: 1959.

Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.

Status: Planned.

Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.)

Project: 625 miles of 12-in. from Mendoza to San Lorenzo.

Status: To start 1st quarter 1958.

Completion: Mid-1960.

Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blanca on the coast.

Status: Bids requested.

- **Yacimientos Petroliferos Fiscales Bolivianos**

Project: 174 miles of 10-in. and 44 miles of 8-in. from Sicasica, Bolivia, to Arica, Chile.

Status: Planned.

Contractor: **Williams Brothers Co.** and **Telescopic Pipe Line.**

Completion: October 1958.

Foreign Products Pipelines

- **Empresa Nacional de Petroles** Government of Chile and Cia de Petroles de-Chile (Copec), et al.

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This unretouched photograph, taken by Edmund F. Hawes, UOP Staff Photographer, was awarded First Prize in the 1956 ASTM Photographic Exhibit.

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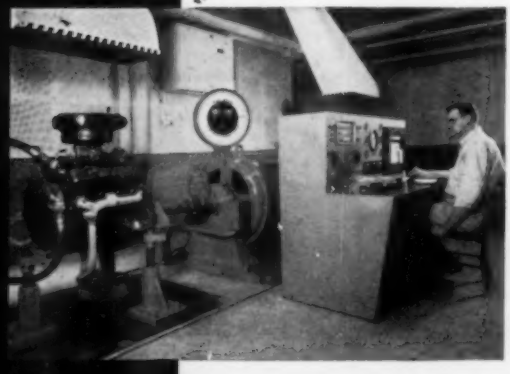
The old problem of the fouled-up spark plug is less acute today because of modern improvements in petroleum refining. Most refiners are taking the utmost precautions to make sure that the motor fuels they produce burn clean, quick and with the full power needed for today's high compression, high-speed engines. Throughout the refining industry research technicians are constantly checking the fuels their refineries produce to help guard against plug fouling and to maintain all the high performance characteristics demanded by today's automotive engines. In this way they are helping to make and keep the products you market salable. Here at UOP, in our business of developing processes for the manufacture of motor fuels, we also never take our eyes off the performance of the end product. Our research and technical staffs are constantly concerned with the fuels made by UOP processes to make sure that these will have the performance qualities that will give their ultimate users full satisfaction. This is only part of the broad contribution research is making toward the salability of products from petroleum. Wherever you market, you can be sure that "men of science" are constantly working to keep the products you sell at the quality level your customers demand.



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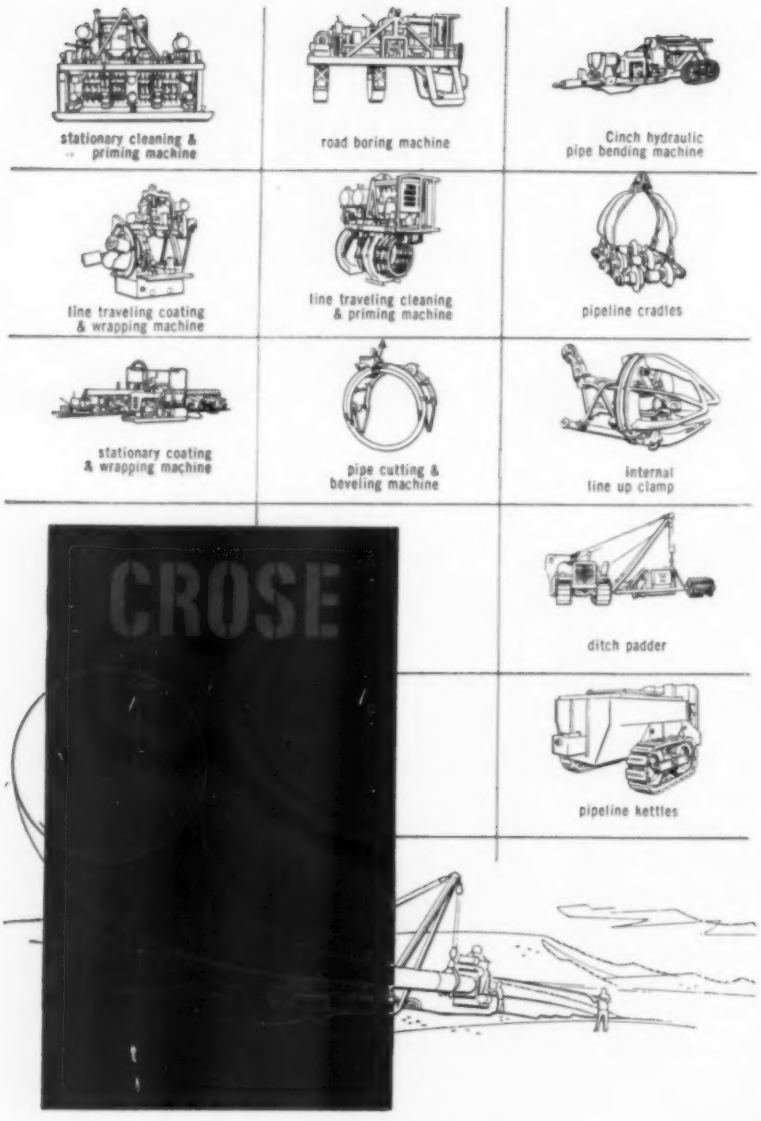

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PIPELINE CONSTRUCTION

Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.
Status: Under way.
Contractor: **Williams Brothers.**
Completion: 1958.

- **National Iranian Oil Co.**

Project: 90 miles of 12-in. from Abadan to Ahwaz, Iran.
Status: To start spring 1958.
Contractor: **Entrepose Co.**, Paris.
Completion: Summer 1958.

Foreign Natural-Gas Pipelines

- **Attock Oil Co.**

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

- **City of Riyadh, Saudi Arabia**

Project: 182 miles of 10-in. from Ghawar field to Riyadh.
Status: Planned.

- **Cuban Gas Transmission Co.**

Project: 650-mile pipeline from Campeche area of Mexico across Yucatan and on the ocean floor to Havana, Cuba; 150 miles would be submarine.
Status: Being studied by Ebasco Services.

- **Gaz de France**

Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. terminal to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.
Status: Under way.
Contractor: French contractors.
Completion: First stage in 1958; complete system in 1960.

- **NIOGAS**

Project: 160 miles of 6, 8, 10, and 12-in. from Fischamend field to Vienna and other Austrian cities.
Status: Under way.
Contractor: **Williams Brothers Co.** and **Costain-John Brown, Ltd.**
Completion: Fall 1958.

- **North Thames Gas Board**

Project: Will extend its Shellhaven-to-Romford line to Coryton then to Canvey Island.
Status: Planned.
Completion: Summer 1958.

- **Petroleos Mexicanos.**

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey.

- **Sui Gas Transmission Co.**

Project: 310 miles of 16-in. from Sui gas field to Moultan, Pakistan.
Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.
Contractors: **Pakistan Constructors**, a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.**, of London.
Project: 145-mile line from Sylhet to Dacca, East Pakistan.
Status: Under consideration. If approved construction could start December 1958.

- **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venzuela.**

Project: 207 miles of 26-in. from Anaco fields to Caracas.
Status: Under way.
Contractor: **Williams Brothers Co.** has part.
Completion: Spring 1959.
in the Northern Caucasus to Moscow, to

- **Yacimientos Petroliferos Fiscales** (Argentina)

Project: 1,015 miles of 24-in. from Camp Duran to Buenos Aires.
Status: To start first quarter 1958.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.)
Completion: Mid-1960.

Among the

Drilling Contractors

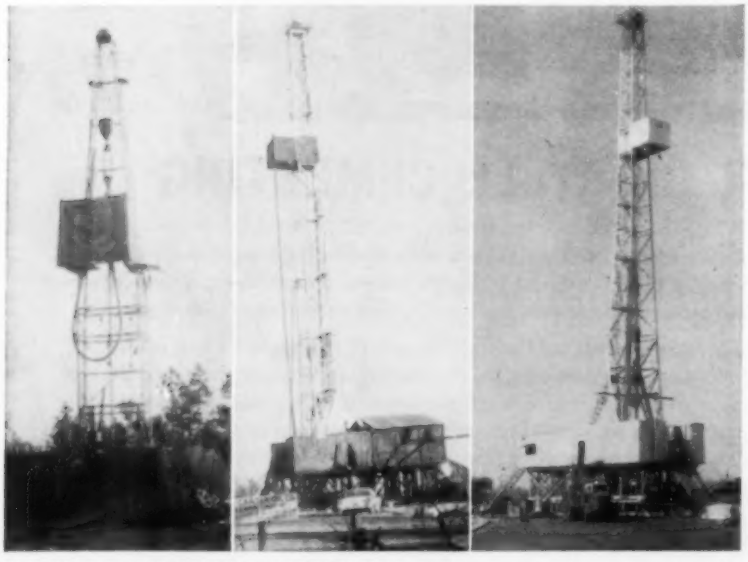
C. J. Foster Drilling Co., Richmond, Tex., is getting well down on an 8,000-ft. wildcat test it is drilling 7½ miles north of Katy, in northwestern Harris County, Texas Gulf Coast. It is drilling for Sam G. Harrison, of Houston. Location, at 1 Logenbach, is about 2½ miles northeast of production in Katy field.

T. T. Eason & Co., Oklahoma City, has a rig working for C. J. McMahon, Inc., in Southwest Stockholm field, in Harper County, western Oklahoma. It currently is on 2 South Bend, a Tonkawa sand test, in 20-26n-23w. It also has a rig on an Oil Creek test east of Norman, in Cleveland County, Central Oklahoma, where it is drilling for George and Herman Brown. This location is at 2 Wilcox, in 35-9n-2e. T. T. Eason & Co. is a division of Eason Oil Co.

Woolf & Magee, Tyler, Tex., have the contract for another deep test in the Sugar Creek area, Claiborne Parish, North Louisiana. They will drill for A. J. Hodges Industries, Inc., of Shreveport. The new operation, 1-A Dobbins, in 12-19n-6w, is more than 1½ miles from the nearest deep well in the field. It will be taken to the Cotton Valley about 9,000 ft.

Carnes W. Weaver Drilling Co., Houston, is associated with Group Oil Co., also of Houston, in the drilling of a projected 9,200-ft. wildcat test 6 miles east of Nome, in Jefferson County, Texas Gulf Coast. Weaver will do the drilling as contractor. The test, 1 Broussard, in the W. L. Stark Survey, is about 3 miles from nearest production, in Boyt field.

A. W. Williams Drilling Co., Inc., Mobile, Ala., has a new wildcat operation under way in Madison County, Central Mississippi. It is drilling for Love Petroleum Co., whose location is about 4 miles northeast of Sharon, at 1 Hill, in 26-10n-4e. Objective is Eutaw sand about 5,350 ft.



HIGHLY VARIABLE DRILLING CONDITIONS in northwestern Arkansas require the use of a variety of sizes and types of rigs. Some of the different rigs now operating in the area, where exploration and development of gas reserves are expected to pick up this year, are pictured above. At the left is a portable, truck-mounted light rig which M-P-W Drilling Co., Covington, Okla., is using to drill for Carter Oil Co. in the shallow (1,200-ft.) Jerusalem field, in Conway County. The medium-depth rig in the center is being used by B. M. Graw, Oklahoma City contractor, to drill with gas for Carter in Moreland field, in adjoining Pope County. Parker Drilling Co.'s large rig (right) is being used for deeper exploratory drilling for Gulf Oil Corp. in the Paris area, Logan County.

INSURANCE AGAINST WASHOUTS

If mud gets to your joint threads, it can wash out a string in a hurry. 'Bestolife Lead Seal Tool Joint and Casing Compound gives maximum, tight joint make-up, keeps mud out. Standard of the oil country for over twenty-five years. Unconditionally guaranteed. Packed in 1¼, 5, 20 and 50 lb. containers. Sold by leading supply houses throughout the world.

INCREASE PRODUCTION

CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less downtime, use world famous Miller Sand Pumps.

Write for descriptive price list.

SAND PUMP SIZES IN STOCK

O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 in.
Lengths, 20, 25, 30 ft.

Composite Catalog Page 3419

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General Offices, Box 4516
Oklahoma City 9, Okla.

EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK 20, N. Y.

HELP CHECK *corrosion* BEFORE IT STARTS...

WITH BETTER OIL WELL CEMENTING

The damaging effects of corrosion are obvious even above ground, but since corrosion generally proceeds faster at higher temperatures, corrosive attacks on oil well casing are even more prevalent at elevated downhole temperatures.

Because corrosion occurs only in the presence of moisture, oil well cementing has an outstanding record of aiding in the prevention of casing corrosion before it gets a chance to start. Cement slurries, carefully formulated and blended to meet the special requirements of your wells, form protective barriers against water that help prevent costly corrosion.

Oil well cementing is greatly aided by diesel oil cements, chemical dispersants and retarders specially developed by Halliburton... and adapted to your well conditions by Halliburton application engineers.

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

HALLIBURTON CHEMICAL PRODUCTS HELP CEMENT COMBAT CORROSION

Cement prevents corrosion by filling the outside annulus and thus protecting the pipe from contact with water. Here are several Halliburton additives which help cement do a better job.

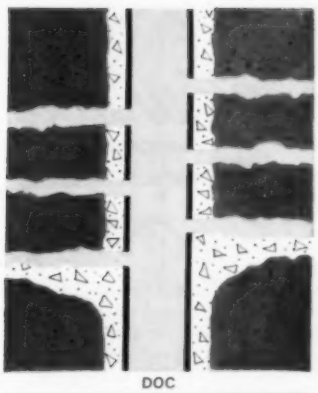
DOC (Diesel Oil Cement)—DOC is composed of cement, diesel oil and Halliburton's efficient dispersant DOC-3 and cannot set until contacted by water. Water contact thickens the slurry, which reduces the volume of materials required to obtain a satisfactory squeeze job.

The DOC slurry is particularly adaptable in repairing casing leaks, and through special techniques it is very efficient in sealing split pipe.

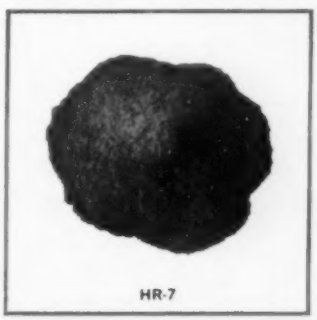
HR-4—A small amount of HR-4 added to the mixing water or the dry cement at Halliburton bulk plants results in a composition with a retarded set, permitting placement at high temperatures. It is used with portland or Pozmix Cement in the deepest of wells.

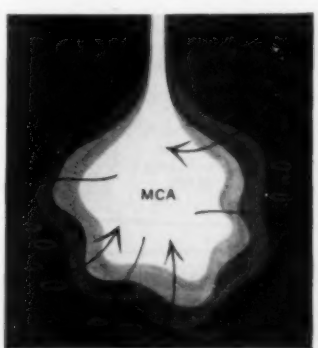
HR-7—Used mostly in wells of moderate temperature, HR-7 is a chemical dispersant and retarder designed for high gel cement compositions. HR-7 is effective in obtaining smoother and more fluid gel cement slurries.

MCA (Mud Cleanout Agent)—Research has shown that MCA is an efficient mud dispersant solution. It is used ahead of cement slurry to remove mud. It helps clean out mud and soft filter cake in the annular space, reducing the possibility of channeling and effecting a better cement bond to casing.


DOC

HR-4


HR-7


MCA

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PERFECT SEAL
Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!

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Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

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With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

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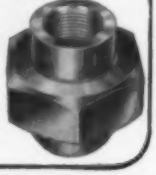
With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

FULL STAINLESS & FULL ALLOY STEEL UNIONS
With screwed or socket weld ends. 3000-lb. and 8000-lb. service.



WRITE FOR CATALOG 56
Showing the Complete Catawissa line of Perfect Seal Products

CATAWISSA VALVE & FITTINGS COMPANY
450 MILL ST., CATAWISSA, PA.

Nearest production is at Loring, about 5 miles northwest, where Carter Oil Co. has two 12,000-ft. Smackover gas wells.

Pioneer Oil & Gas Co. has a rig under contract to Seaboard Oil Co. for another Smackover test the latter company is undertaking on its large lease spread in eastern Wilcox County, southern Alabama. It is Seaboard's third test in the area. The new location is at 1 Rollins, in 16-12n-10e, about 12 miles east of Camden. Contract is for 6,000 ft.

J. R. Mumme Drilling Co. is contractor on a new wildcat operations for Frio Production Co. in eastern Duval County, South Texas. It is a 6,150-ft. test at 1 Crescenciana Hinojosa, in the R. Gutierrez Survey 12, about 13 miles south of San Diego.

Howard Parker Drilling Co., Houston, has a new contract job in the Louise area, western Wharton County, Texas Gulf Coast. It is a 7,500-ft. Frio-Vicksburg test for Morton & Dolley, of Los Angeles, Calif. Location, at 1 Cappell-Stovall, in the Morris & Cummings Survey, Section 27, is 5 miles southeast of Louise, and about a mile east of Louise field.

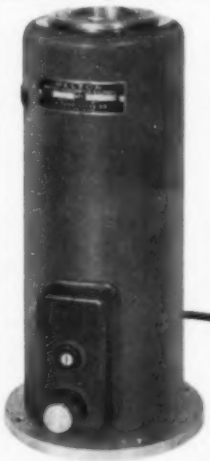
Kullberg & Otthouse, Inc., Cut Bank, Mont., has a new wildcat operation in Phillips County, northern Montana. It is drilling on contract for Flank Oil Co. Its location, at 1 Government - Barr, in 22-30n-31e, is southwest of Bowdoin field. Madison is its objective.

Robinson Drilling Co. is drilling on a new operation Coloma Oil & Gas Corp., of Corpus Christi, is undertaking in the recently opened Blanche field, 5 miles north of Louise, in western Wharton County, Texas Gulf Coast. Coloma's location is 1,150 ft. south of the area's discovery well drilled for Robinson Oil & Gas Co. Contract is for 5,800 ft.

Offshore Drilling Co. has put two rigs to work for Pan American Petroleum Corp. in Atchafalaya Bay, just off Point Au Fer, at the southwestern tip of Terrebonne Parish, Louisiana. They are on tracts adjoining the tract on which **Clegg & Hunt,** of Houston, have a rig running for the same company. The latter contractors are drilling below 17,000 ft. on their contract, located in Tract 3134. Permits on Offshore's locations call for 11,500-ft. tests. All are wildcat tests several miles north of Point Au Fer gas field.

The L-K (Melton)
HEATING HYDROMETER CYLINDER
Assures Correct Gravity Readings!

The L-K (Melton) unit is an improved type of Heating Hydrometer Cylinder. It furnishes a practical way of heating samples of waxy crudes so that hydrometers will float in them, and this insures correct gravity readings of such samples.



Pat. Pending

This unit has many advantages. It is explosion proof. It is of all aluminum construction and has a strip-type heating element which may easily be replaced in the field when necessary.

The unit has a thermostatically controlled heating range of approximately 50° to 240° F., and is furnished with removable Pyrex inner cylinder.

The cylinder can be furnished for 6 volts D.C., 12 volts D.C., or 115 volts A.C. Inside dimensions conform to API specifications.

Write, wire, or phone for additional information.

L-K PUMP VALVE CO.
P. O. Box 901 Houston, Texas

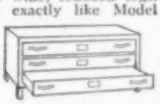
KRAFTBILT
OIL INDUSTRY FILING EQUIPMENT

ELECTRIC LOG FILE E-27

NEW, deep-drawer filing cabinet for reduced, electric well logs 6½" or less in width.

This 7-drawer unit is the newest addition to the quality KRAFTBILT line of log cabinets. Deeper drawers accommodate easily the wider, reduced logs. Each drawer will hold 600 reduced well logs. Total file capacity is 4,200 of the wide, reduced logs. Size and construction exactly like Model E-28.

Model E-28 Electric Log Cabinet



Model G-34, G-36 Strip Log Cabinet

Filing Supplies to fit perfectly are available for all KRAFTBILT units.

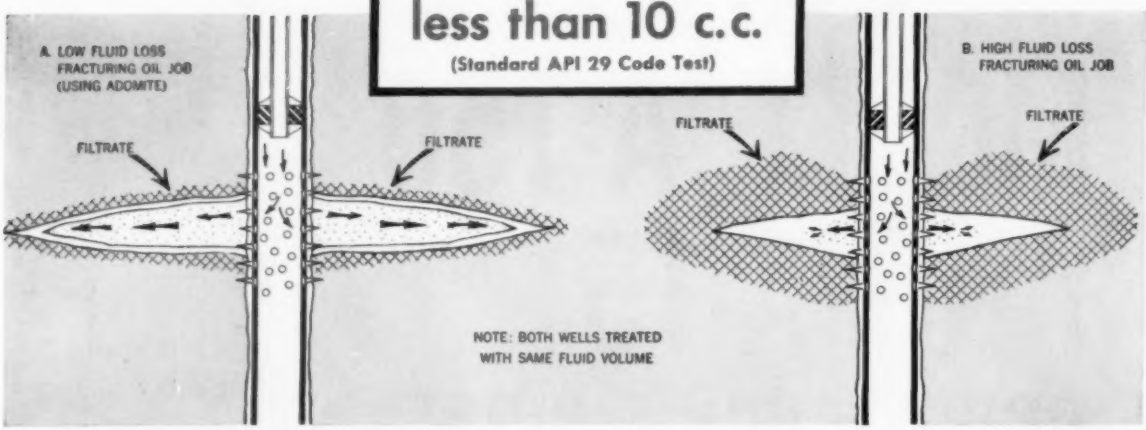
WRITE for Catalog 58-B on Kraftbilt

ROSS-MARTIN COMPANY
P. O. BOX 800 TULSA 1, OKLA.

For more productive fracturing . . . least fluid loss

specify Adomite®

Cuts fluid loss to less than 10 c.c.
(Standard API 29 Code Test)


A. LOW FLUID LOSS FRACTURING OIL JOB (USING ADOMITE)
FILTRATE
FILTRATE
NOTE: BOTH WELLS TREATED WITH SAME FLUID VOLUME
B. HIGH FLUID LOSS FRACTURING OIL JOB
FILTRATE
FILTRATE

Adomite is the remarkable fluid-loss control additive that is building production and profits virtually everywhere it is used. Very small amounts of Adomite reduce the API fluid loss of lease crudes to 10 c. c. at most reservoir conditions. With gelled crudes, even smaller quantities are required. *Easy to use*, Adomite is a dry material in flake form that is mixed directly into the crude or gelled crudes on the lease. Only standard mixing equipment is required.

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Only Adomite can do so many things so effectively . . .

- Seals the fracture face—minimizes fluid loss.
- Longer fractures—deeper penetration of sands.
- Greater sustained production with a given fluid volume at lower cost.
- Saves you money—utilizes lease crudes—less pumping.
- Cleans up quickly—does not contaminate produced oil or the formation.
- Fewer "Sandouts."
- Profitably used for "drilling in" and "work overs."

Be sure to specify Adomite on your next fracture job

MOST VERSATILE NEW SERVICING

CARDWELL MODEL A-150 AND A-151

DOUBLE DRUM HOISTS

with optional spudding or rotating drive

Here are the most efficient servicing units in the lightweight class — to date! Model A-150 is powered by a rugged oil-field-type engine, and Model A-151 features PTO drive from truck engine.

Both of these versatile double-drum hoist units are rated to 5,000 feet servicing with 2½-inch tubing, but have been operated on occasion at greater depths. Both will spool 11,000 feet of ½-inch swab line. Either unit can be used for rotary drilling to 2,500 feet with 3½-inch drill pipe.

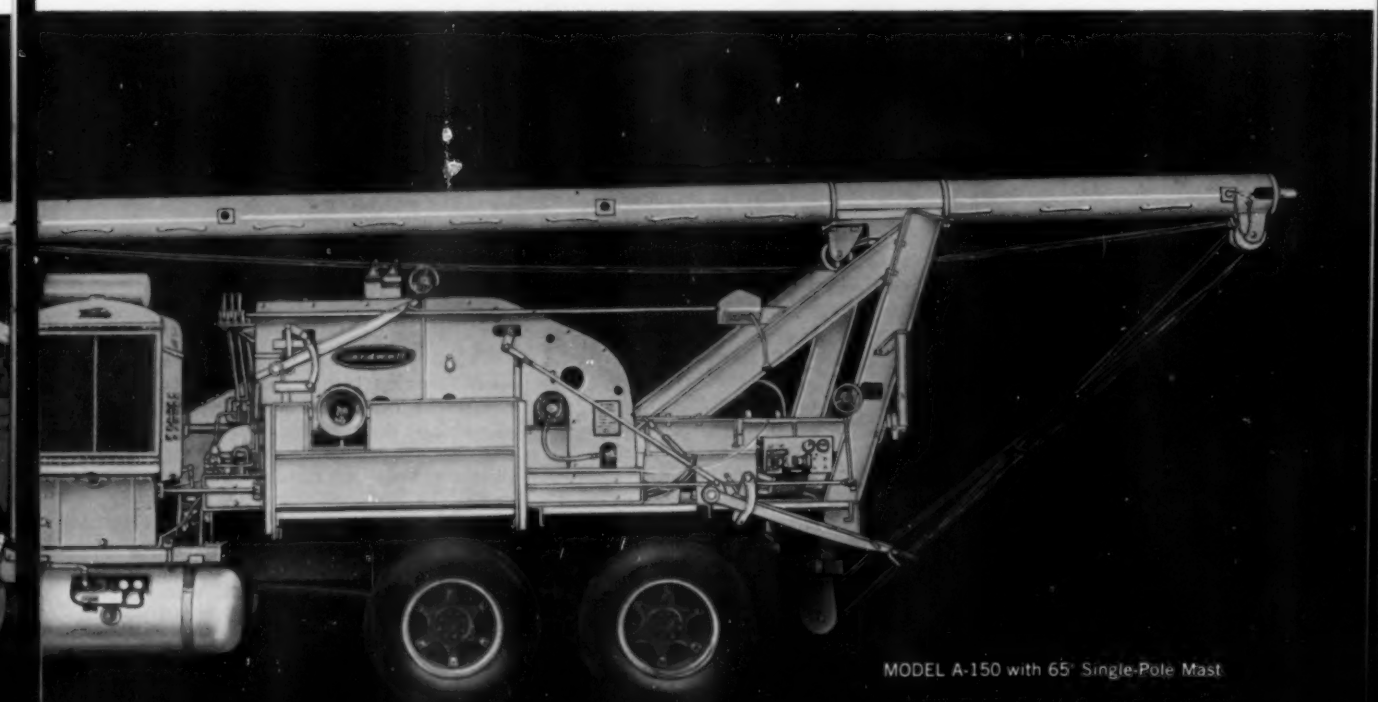
Nominal input is 120 HP, with five forward and one reverse speeds to hoisting drum, sand line drum, and rotary drive.

Increased versatility is obtained when these new Cardwell units are used with Cardwell's structural masts. Masts are equipped with outriggers to eliminate ground guy lines, and are prepared for hanging rods and standing tubing.

These new servicing units are just two of many new achievements Cardwell has planned for the industry in 1958. FOR **TOMORROW'S** EQUIPMENT... KEEP YOUR EYE ON CARDWELL — **TODAY!**

ADAPTABLE TO ANY OF THESE CARDWELL MASTS

UNITS IN THE FIELD TODAY!



MODEL A-150 with 65' Single-Pole Mast

MODEL A-151 with
65' Single-Pole Mast

55-foot Single-Pole Mast
55-foot Double-Pole Mast
65-foot Single-Pole Mast
65-foot Double-Pole Mast
50-foot Non-Telescoping Structural Mast
65-foot Telescoping Structural Mast

STAND-OUT FEATURES!

- Cardwell "Flex-Disc" air clutches for main and sand line drums.
- Safety-designed controls optional between skid level and ground level.
- Both main and sand line drums have two self-energized full-wrap brakes with single-point adjustment.
- Will accommodate most Cardwell single- or double-leg pipe masts and structural masts.
- Model A-150 engine driven with torque converter optional.
- Model A-151 drives from truck engine with power take off. Torque converter optional.

FOR FULL INFORMATION, CALL YOUR NEAREST CARDWELL REPRESENTATIVE

cardwell MANUFACTURING COMPANY

BOX 2001, WICHITA, KANSAS, U. S. A.

SHOWCASE...

NEW EQUIPMENT

Hot-asphalt plant speeds paving repair

Features of the Model PM-430 Patchmobile include a rotary dryer for drying aggregate, a separate pugmill for mixing aggregate and asphalt, and a 250-gal. hot-asphalt storage tank.

The plant can be towed by the dump truck hauling sand and gravel for the mix. Material is shoveled from the truck into the charging hopper. It is then fed from the charging hopper by a reciprocating feeder into the dryer and passes through the dryer into the batching hopper. When the machine operator discharges the material in the batching hopper into the pugmill, a preset amount of asphalt is automatically sprayed into the mix. The mixed material from the pugmill can be discharged into the shoveling pan, onto the pavement, or into a wheelbarrow, as desired. **Write or call: Wylie Mfg. Co., Inc., 640 North Meridian, Oklahoma City, for details on Model PM-340 Patchmobile.**

●

Pipe Insulation Has Built-In Tie Wires

This 101 pipe insulation is a new speed-fastening, high-temperature pipe covering that employs built-in tie wires to eliminate the need for conventional tie wires. It can be applied to large-diameter lines as rapidly as more costly molded-pipe coverings, the maker says.

Specially felted from high-temperature, moisture-resistant spun mineral wool, the pipe insulation will withstand temperatures to 1,200° F. Its exterior surface is faced with a metal fabric of 16-gage wires tied through the spun wool to an inner facing of 1-in. expanded-metal lath.

Fastening on pipe is accomplished by hooking seven wires, extending from one end of the outer mesh fabric, under the opposite stay wire and bending them over and back.

The maker reports the pipe insulation is especially suited for covering nested pipes and steam-traced lines. It can be manufactured to fit exactly with no waste material. Having a low alkalinity factor, it will not corrode pipes in the presence of heat and moisture. It is available in 2-ft. sections and 1½ to 4-in. thicknesses for pipe sizes from 4 to 30 in. **Write or call: Engineering Dept., Baldwin-Hill Co., 500 Breunig Avenue, Trenton, N. J., for details on 101 pipe insulation.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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Described in OIL AND GAS JOURNAL - Issue of **February 17, 1958**

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CITY.....STATE.....

DATE.....

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Pumping units are not to be tried out as a lark. However, sometimes it is well to try a product proven in use by others. If Cabot pumping units have not been among the brand or brands you have recently purchased . . . TRY ONE. It may prove to be more economical than what you are now using. Cabot is a quality pumping unit minus the frills. It is built for most economical overall cost (original outlay less maintenance over the life of the unit) and dependable rugged pumping, 3,000 to 32,000 pounds maximum polished rod load.

See your J & L Man, or write Cabot for engineering specifications or recommendations

OIL FIELD PUMPING EQUIPMENT

CABOT

PAMPA, TEXAS

FRANKS DIVISION OF CABOT

A BETTER BLOCK
FOR EVERY PURPOSE

McKISSICK
SPEED NUT
SNATCH BLOCK
Is quick and safe

Eliminates all lower bolts facilitating easy opening and closing.

Two quick turns of "speed nut" and block is ready to open or close.

"Speed nut" is never completely removed and cannot be lost.

McKissick Builds A Better Block For Every Purpose.

Catalog on Request

McKISSICK PRODUCTS CORPORATION

Loading boom is hydraulically operated

The marine loading boom shown is constructed of 8 and 10-in. steel pipe, swivels, and fittings and is classed as an 8-in. boom. Sizes are available to 18 in. The boom reach ranges from 20 to 60. ft.

The boom uses four hydraulically operated swivels powered by a flexible shaft of 1-in., 6 by 41, three-strand wire rope. It employs no counterweights for its free-riding movements. When flanged to a barge or tanker, the boom's hydraulic components allow it to rise and fall and pitch and roll with the vessel.

The boom is stored in the vertical position above its base, easily clearing the face of the dock.

In the design of the boom, special attention was given to reduce pressure drop and the net positive suction head needed when the boom is employed on the suction side of a pump. No obstructions restrict flow through the boom. For products with a high viscosity, the boom can be readily steam traced. For those of a corrosive nature, the boom can be fabricated of stainless steel or Monel. **Write or call: Powered Pipe, Inc., 746 South Wesley Avenue, Oak Park, Ill., for details on Marine loading boom.**

•

LPG Metering Assembly Comes As Unit

Providing capacities to handle 30 to 80 g.p.m., the LPG metering assembly incorporates a Brodie birotor meter, strainer, and differential valve for use in loading facilities, tank trucks, fueling operations, and other bulk transfers.

Advantages cited for the birotor measuring element in handling critical LPG volatiles include: (1) positive-displacement accuracy, (2) maintenance of close tolerances through elimination of metal-to-metal contact which might cause wear within the measuring element, (3) freedom from vibration achieved by static and dynamic balance of the two spiral-fluted rotors—the only moving parts in the

measuring chamber, and (4) simple unit-built assemblies permitting inspection or replacement of the measuring element without disturbing line connections. Drive adjustment may be made while the meter operates.

Each assembly is available with a printing counter with seven-figure totalizer, four-figure set back, and 1/10-gal. indicator; or a counter with seven-figure totalizer, five-figure set back, and 1/10-gal. indicator. The counters may be faced in any of 12 positions. **Write or call: Ralph N. Brodie Co., San Leandro, Calif., for Bulletin 651.**

GASOS ARE STANDARD WITH US

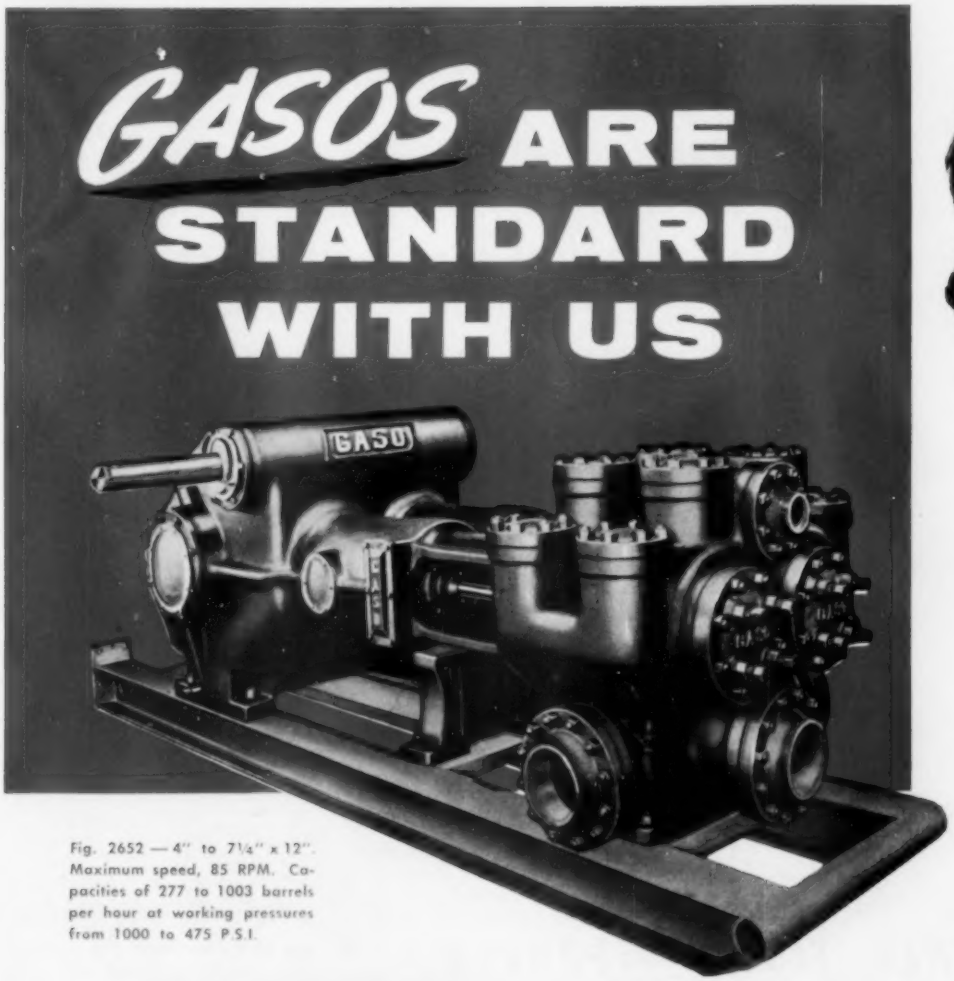

Fig. 2652 — 4" to 7¼" x 12". Maximum speed, 85 RPM. Capacities of 277 to 1003 barrels per hour at working pressures from 1000 to 475 P.S.I.

. . . BECAUSE THEY TAKE THE GUESSWORK OUT OF PUMP BUYING

As engineers, the men in my department deal in facts. They know from experience that Gaso offers models exactly suited to our various needs. They know from our service records that Gaso Pumps consistently deliver top service for unbelievably long periods, with remarkable low maintenance and upkeep costs. And they know from personal contact that they can rely on Gaso distributors for on-the-spot information, recommendations and parts service. Add up the advantages and you'll understand why we, as engineers, took the guesswork out of pump buying by making the specification of GASOS a company policy.

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for every oil industry need

REPORTS OF PERFORMANCE

from users during the past 16 years show that Kennametal* lasts 20 times longer than steel and 3 to 5 times longer than special and super alloys.

• A Texas producer reported sand abrasion forced a pulling job every 14 to 20 days. After 448 days on the job, Kennametal Balls and Seats showed no wear when well was pulled for other than valve job.

INDUSTRY AND **KENNAMETAL**
...Partners in Progress

Kennametal API Balls and Seats are available at repair shops of most major pump manufacturers. Ask your service man to standardize on them. They'll cost you less in the long run. KENNAMETAL INC., Latrobe, Pennsylvania.

*Kennametal is the Trademark of a series of hard carbide alloys of tungsten, tungsten-titanium and tantalum.

DESIGNED, TESTED AND PROVEN IN THE OIL FIELDS

Screened Air Port

Unexcelled . . . for Outdoor Use

- DRIP PROOF
- VERMIN PROOF
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- CORROSION RESISTANT
- FORCED AIR COOLED

All these features of Fieldmaster Ball Bearing Motors have been designed to overcome the rugged conditions of Oil Field requirements.

CHECK THESE OUTSTANDING ADVANTAGES.

Heavy Cast base for alignment, stability, heavy duty, double-shielded, prelubricated bearings, reduces lubrication worries, high grade silicon steel in the magnetic circuit reduces iron losses . . . Wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems. High slip is available to take care of reciprocating load requirements encountered in pumping.

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Write For Descriptive Literature.

BETHLEHEM SUPPLY CO. TULSA, OKLAHOMA

Manufactured by VALLEY ELECTRIC CORPORATION, St. Louis, 8, Mo.

SHOWCASE . . .

New Equipment

Drain Valve Eliminates Line Drainage

Originally designed for use in aircraft fuel tanks and lines, the drain valve offers a number of applications where tank drainage or leakage is a cost factor.

A double-poppet type, the valve has a secondary seal which permits the primary valve poppet to be released without loss of fluids. The second seal also can quickly stop a leak when immediate primary-seal replacement is impossible or inconvenient, the maker reports. **Write or call: Clark Dynamics, 408 Junipero Street, San Gabriel, Calif., for details on double-seal drain valve.**

•

Jet Gun Shoots Line Through Conduit

Designed to speed installation of wiring, the device is simple to operate and saves hours over old-fashioned "snaking" methods, the maker claims. A packaged spool of nylon line is attached to a sealed cartridge of liquefied gas and muzzle-loaded into the gun. After insertion of the barrel into the conduit, a trigger actuates a "firing" pin. This pin punctures a hole in the cartridge, releasing the jet action of compressed, liquefied gas.

The cartridge travels through the conduit at high speed, laying the line behind it. Effective distance of 400 ft. in straight runs can be attained.

The Jet-Line gun has been tested in both vertical and horizontal runs. It can also be used for fishing in underfloor ducts and similar raceways as well as in flexible conduits. **Write or call: Graybar Electric Co., Inc., 420 Lexington Avenue, New York 17, for details on Jet-Line gun.**

Graver Heaters, Treaters, Separators and Tanks now available through Ideco's world-wide affiliates

For 100 years Graver has been a pace-setter in the manufacture of oil and gas storage and processing equipment with an outstanding record of long life and trouble-free service. Graver products are precision-built to A.P.I. specifications and sizes. Whatever the climate or condition Graver is your wisest choice. Ask your Ideco man for full details on this equipment.

IDECO RECOMMENDS:

Graver Bolted or Welded LEASE STORAGE TANKS . . . Low or High Pressure Oil and Gas SEPARATORS — Horizontal, Vertical or Spherical Types . . . Vertical Pressure or Atmospheric EMULSION TREATERS . . . Glycol Type Gas DEHYDRATORS . . . Oil and Gas HEATERS — Direct or Indirect . . . One-Well Cold SEPARATORS (CONDENSAVERS) . . . WALKWAYS, STAIRWAYS, STACKS, FLUMES, APRONS and Other Tank ACCESSORIES.

Now, Ideco, the unchallenged leader in the export of oil field equipment, is linked with another great name to bring you the finest in oil and gas processing units and lease storage tanks. From anticline to pipeline, from drilling to storing, Ideco's world-wide affiliates can supply all your petroleum equipment and supply requirements.

ONE-PACKAGE EXPORT SERVICE

Through its One-Package Export Service, Ideco offers a "one source" responsibility for all petroleum equipment and oil field supplies. Other unique advantages include a complete planning and purchasing service . . . an experienced rig-up, testing and export shipping service, and a nearby deep water port equipped for handling heavy machinery.

GRAVER

100 Years — 1857 to 1957

SALES REPRESENTATIVES: Ludwig Honegger, Bruno A. G.
Rustan Pumpkins, Dresser International, Inc.

IDECO Inc.

D1

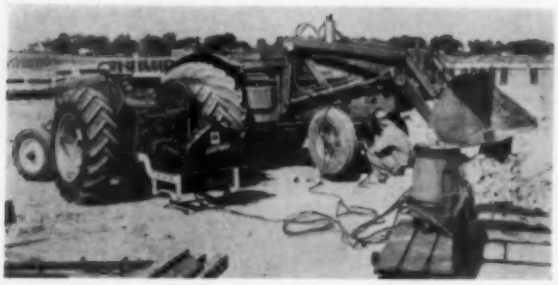
P. O. BOX 1331 • DALLAS 21, TEXAS

SHOWCASE . . .

New Equipment

Electric Generator Is Tractor-Driven

Delivering 12.5 kva. of standby power, this Electrall now is available for use with any make of 25-hp.-or-larger tractor as a fast-hitch or trailing model for tractors with an ASAE standard 1⅜-in. diameter, 540-r.p.m. power takeoff.

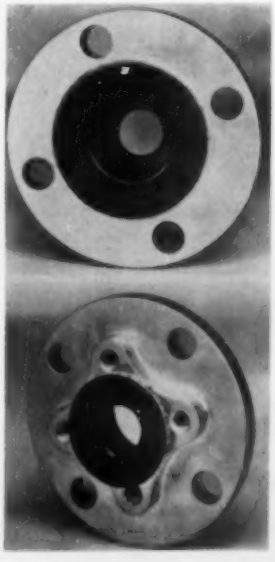


Its principal use is as a standby electrical power unit for emergency use on construction work when power fails or as a source of electrical power for jobs where regular power is not available. It is especially useful as a source of current for welders, motors, impact wrenches, drills, grinders, and lights in making emergency repairs to equipment. The generator produces 115 and 220 volts a.c., 60-cycle, single-phase; or 208-volt, three-phase, 60-cycle power for three-phase motors up to 10 hp. Its load capacity is listed at about 1,800 watts at 115 volts and 6,200 watts at 208-220 volts, single-phase. **Write or call: International Harvester Co., 180 North Michigan Avenue, Chicago 1, for details on Electrall.**

•

Reducing Flange Lined With Teflon

The tapered reducing flange is lined with Fluoroflex-T, a virgin Teflon compound. The full face of the flange, with its asbestos backing, is an integral part of the liner. It provides both corrosion protection and chemical inertness.



Troublesome separate gaskets are not required. The material conveyed cannot contact metal in the reducing-flange assembly, the maker reports.

PLUG VALVES STUCK?

cussin' won't help—but DESCO Lubricants will!

Because DESCO Synthetic Lubricants are ALL lubricant, and contain NO inert material, they will not harden and coke-up in your valves. And no matter what the fluid or its temperature, DESCO Lubricants are designed TO STAY in your valves. Keep valves operating smooth and easy. Eliminate costly valve damage and dangerous leaks.

ONLY 4 STANDARD AND 3 REGULAR Desco Lubricants handle ALL valve services, and most plants require only one or two. Reduce the chance of using the wrong lubricant. Eliminate large warehouse stocks. Specify DESCO.

STICKS OR BULK. Packed in clean, convenient sticks in 5 sizes for gun or jack screw, and in 5-qt., 40-lb. and 100-lb. containers.

Lubricate 'em AUTOMATICALLY

A valve will last longer and operate better when equipped with a DELTA Automatic LUBRICATOR. This simple, low-cost device lubricates the valve each time it is opened and closed. Pays for itself in no time.

DELTA-DESCO

WRITE FOR CATALOG
The Only Complete Plug Valve Lubrication Company

PLUG VALVE LUBRICANTS AND EQUIPMENT

Color Coded Lubricants • Hand Guns
Fittings • Air-Motor Volume Guns
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DELTA ENGINEERING SALES CO.
Box 1403 Shreveport, Louisiana
Branch Offices in All Principal Cities

200 GPM +400 GPM 600 GPM

The PLUS value of Layne Gravel Wall Wells

400 GPM more water delivered by the use of a Layne Gravel Wall Well

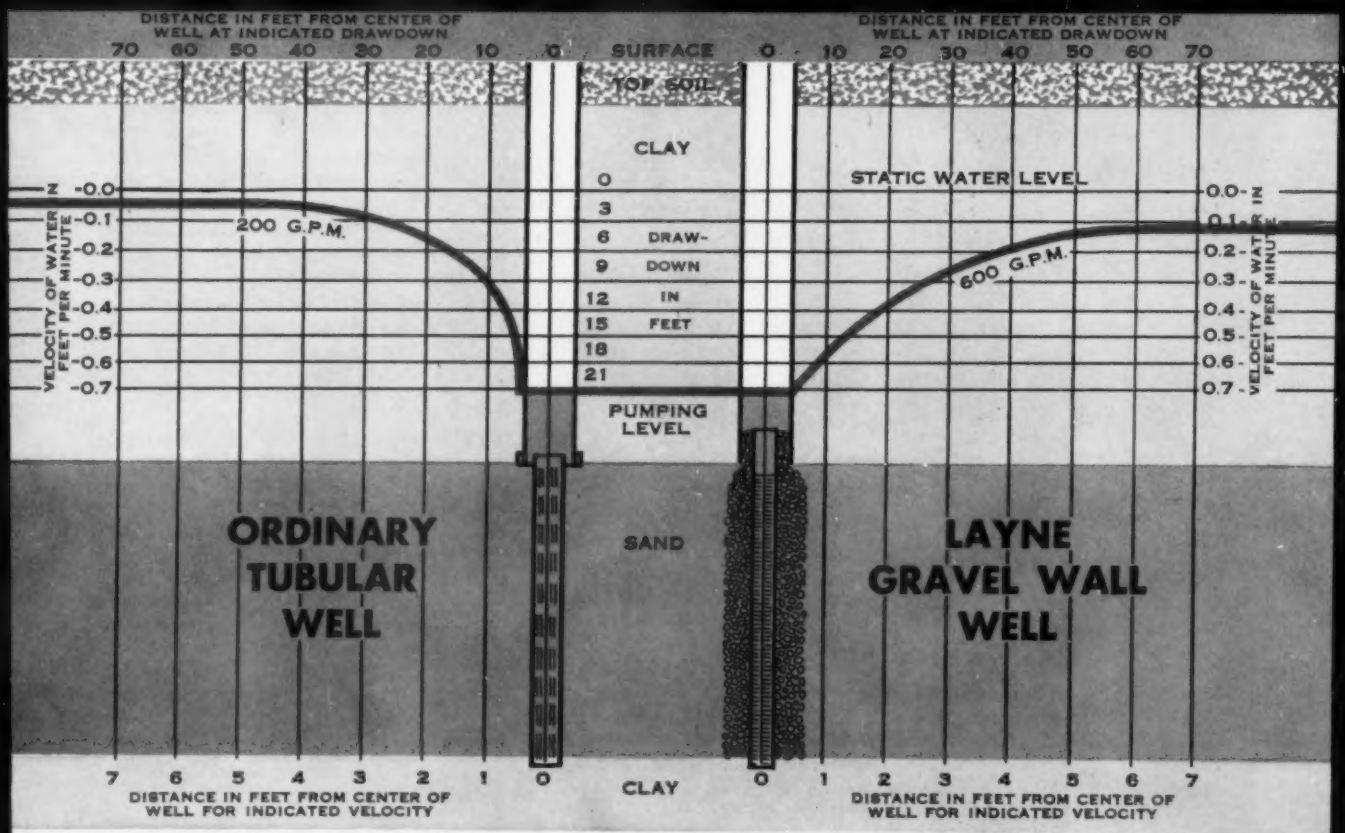
Adequate water and economy are important considerations in every step of petroleum processing. That's why men in the field rely on Layne.

Layne underreamed gravel wall wells equipped with Layne screens permit large screen openings which allow greater inlet velocities and reduce friction which in turn reduces wear on the shutter screen. Drawdown is moderate, pumping head low and operating costs proportionately lower.

Layne gravel wall wells are another example of Layne's experience and leadership in the field—gained around the world for over 75 years.

Our only concern—our only business is water.

PRODUCTION AND OPERATING CHARACTERISTICS OF TWO TYPES OF WELLS.



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General Office and Factory — Memphis 8, Tenn.

Layne Associate Companies throughout the world.

Water Wells • Vertical Turbine Pumps • Water Treatment

LAYNE & BOWLER, INC., Memphis 8, Tenn.

Gentlemen: Please send me bulletin No. CW-9.

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TITLE_____

ORGANIZATION_____

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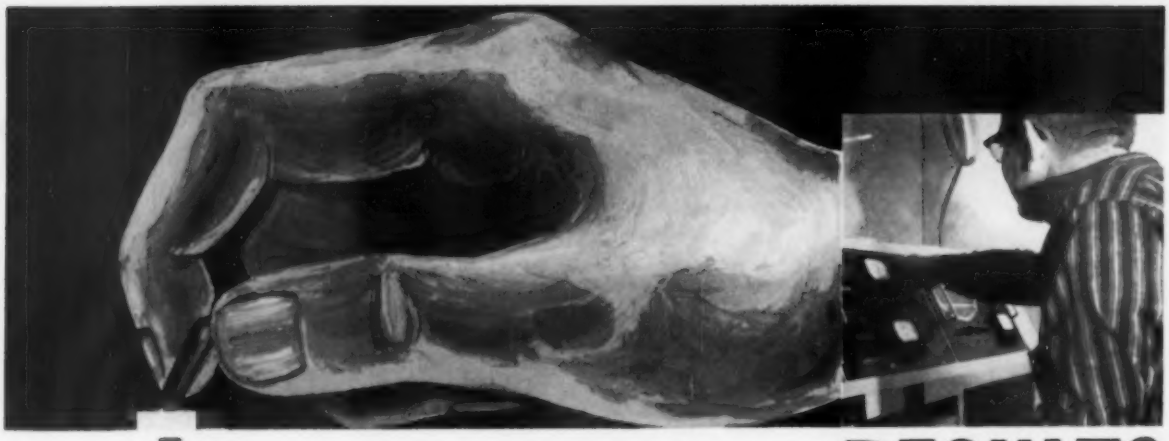
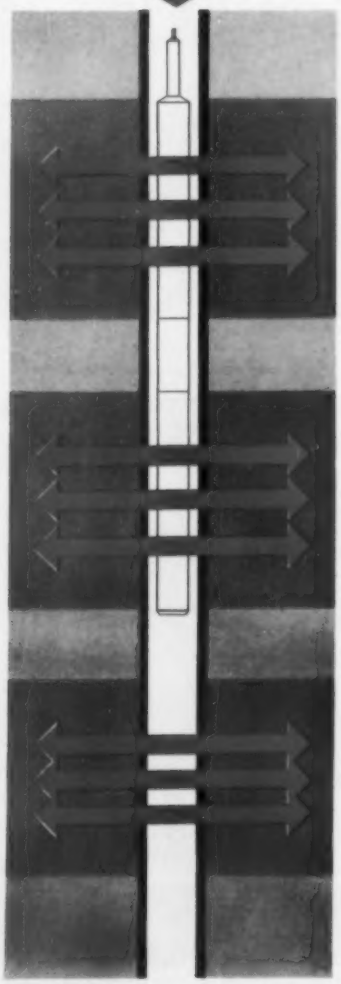


pin ↓ *point engineering* pin-points **RESULTS**



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and here

with Selective Rocket Jet

Western engineering makes the difference

Western research engineering provides the Western field engineer with the most advanced tools and techniques for successful completion and remedial work.

Western engineers combined the industry's most effective jet perforating charge—Rocket J-II —and Selective Rocket Jet, the exclusive selective-fire system, to provide the most efficient casing completion available.

Rocket J-II "all hole—no carrot" provides carrot-free perforations every time, with greater entry hole size and deeper penetration. Selective firing allows perforation of several zones on a single run—with exacting accuracy.

You get the most effective perforations in the most effective zones—all on a single run into the well.

This "combination" of Western engineering advances is only one of the many engineering advantages you will find in Western services and products. Let Western integrate your well servicing program with the pin-point accuracy of **engineered** well services—logging, perforating, fracturing and acidizing.

general offices: Midland, Texas **THE WESTERN COMPANY**

Integrated wire line and pumping services for the Southwest: logging, perforating, fracturing, acidizing.

Contamination by corrosion products is thus prevented.

Thermal shock, which often damages reducers lined with fragile coatings, has no effect on the reducing flange. The flow passage is tapered to minimize turbulence. The reducer withstands 150 psi. and full vacuum at temperatures from —100° to 500° F. The flanges have standard 125 or 150-lb. ASA bolt circles. They are available in sizes from 1 to 6-in. ASA pipe sizes. **Write or call: Resistoflex Corp., Roseland, N. J., for details on Fluoroflex-T reducing flange.**

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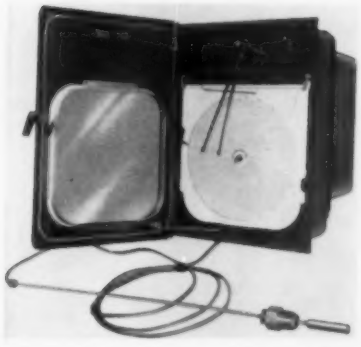


Temperature, B.s. and w. Recorder for LACT Use

An advantage of the combination b.s. and w. and temperature recorder is that assembly of both recording mechanisms in one case simplifies many pipeline installations where separate temperature and b.s. and w. recorders would ordinarily be installed.

The temperature-measuring system incorporated in the unit is a filled type. The bulb is designed for location directly in the pipeline. Connection from the sensing bulb to the recorder is made with flexible, stainless-steel capillary tubing.

One pen of the recorder records b.s. and w. Temperature is recorded on a second pen to provide simultaneous indication of both variables. **Write or call: Instruments, Inc., P. O. Box 556, Tulsa, for details on combination b.s. and w. and temperature recorder.**

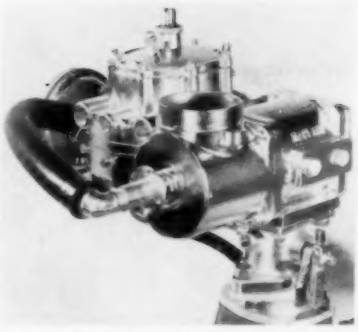
•

LPG Injector Gives Constant Fuel Ratio

Featuring one-piece design, the McClain LPG fuel-injection system offers a constant fuel-air ratio unaffected by temperature or altitude. It reportedly gives fast, safe starting and fast acceleration.

Through a solenoid valve, LPG liquid from the tank enters a single-stage regulator-vaporizer. There pressure is reduced to about 2 psi. Heat from hot water or crankcase oil vaporizes the LPG. A vacuum lock off valve prevents passage of fuel from the vaporizer to the injector until the engine turns over. Then the fuel is metered under pressure into the air stream to maintain a constant fuel-air ratio, regardless of speed or load.

Only engine demand determines the fuel-mixture volume supplied. Engine speed is governed by a throttle blade. No choke is used. The LPG fuel-injection system comes in sizes to accommodate engines with displacements of 50 to 650 cu. in. **Write or call: Carver Industries, Inc., Box 15, Lubbock, Tex., for details on LPG fuel-injection system.**



200 GAS WELLS PROTECTED FROM CASING CORROSION

Problem. To protect the casing in more than 200 gas wells from external corrosion. These wells are in the Kansas section of the Hugoton gas field, and are operated by four companies. Six of the wells are in the sand hills area where soil resistivities are of the order of 20,000 ohm-cms.

Solution: CSI engineers made current requirement tests, and then applied cathodic protection using Galvomags—Dow's high-potential magnesium anodes.

Installations were designed to provide a guaranteed current output, with a minimum protection of 10 years. Current requirements ranged from 0.43 to 2.05 amperes. Costs averaged about $325 per well.

For expert consultation, engineering services or cathodic protection materials, call or write today. Estimates or quotations without obligation.

CSI

CORROSION SERVICES INCORPORATED

Tulsa, Oklahoma

P. O. Box 7343, Dept. J-4 **Telephone: Circle 5-1351**

HARRISBURG PUMP LINERS LAST LONGER

because they're

Diamond Hard

DIAMOND HARD PRODUCTS

You get better pump performance, lower maintenance costs with Harrisburg Super Diamond Hard Pump Liners. Harrisburg Liners are heat treated by a special flame hardening process that provides exactly the right hardness throughout liner body for maximum strength and wear resistance. Liner walls are precision honed to a mirror finish. Every liner receives a rigid inspection, assuring conformity to exacting specifications. Write for complete catalog and prices.

Harrisburg Diamond-Hard fluid-end products are precision-matched . . . Should be used together . . . for superior performance under the most extreme high-pressure, deep drilling conditions.

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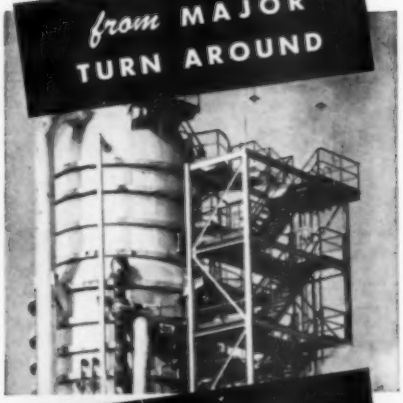
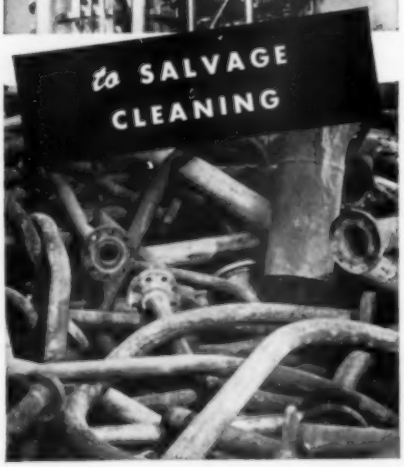
Sales & Service, Inc.
P. O. BOX 1053 1316 CONTI STREET HOUSTON 2, TEXAS

from MAJOR TURN AROUND



to SALVAGE CLEANING



Oakite speeds results . . . cuts costs

In a refinery at turn-around time, the Oakite man recommended in-place cleaning procedures and materials that gave virtually 95% perfect results—cut costly tower down-time 25%.

With Oakite materials removing rust, soil and paint from salvageable pipe, fittings, valves and other parts, one refinery estimates savings in excess of $50,000 a year.

Just two jobs of the *many* where Oakite can help. Bulletin F-7629 tells more. Write Oakite Products, Inc., 39 Rector Street, New York 6, N. Y.

OAKITE

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

SHOWCASE . . .

New Literature

Orifice Meters and Other Instruments are described in five new bulletins now available. The literature includes Bulletin 401, "Integrating Orifice Meters"; Bulletin 402, "Gas Lift Meter"; Bulletin 403, "Two-Position Controller for Parallel Meter Operation"; Bulletin 404, "Dri-Flow Orifice Meter"; and Bulletin 405, "Remote Pilot Unit for Remote Loading of Pressure Regulators." **Write or call: American Meter Co., Inc., 920 Payne Avenue, Erie 6, Pa., for Bulletins 401-405.**

●

"How to Use Platinum Resistance Thermometers in Temperature Measurement, Telemetry, and Control" is the title of a new 15-page booklet. Included are the basis for temperature measurement with platinum and some of the reasons why platinum has been adopted as an international temperature standard. Various types and characteristics of specific-resistance thermometers and their use in a variety of bridge circuits and control systems are described. **Write or call: Trans-Sonics, Inc., Burlington Mass., for Platinum Resistance Thermometers booklet.**

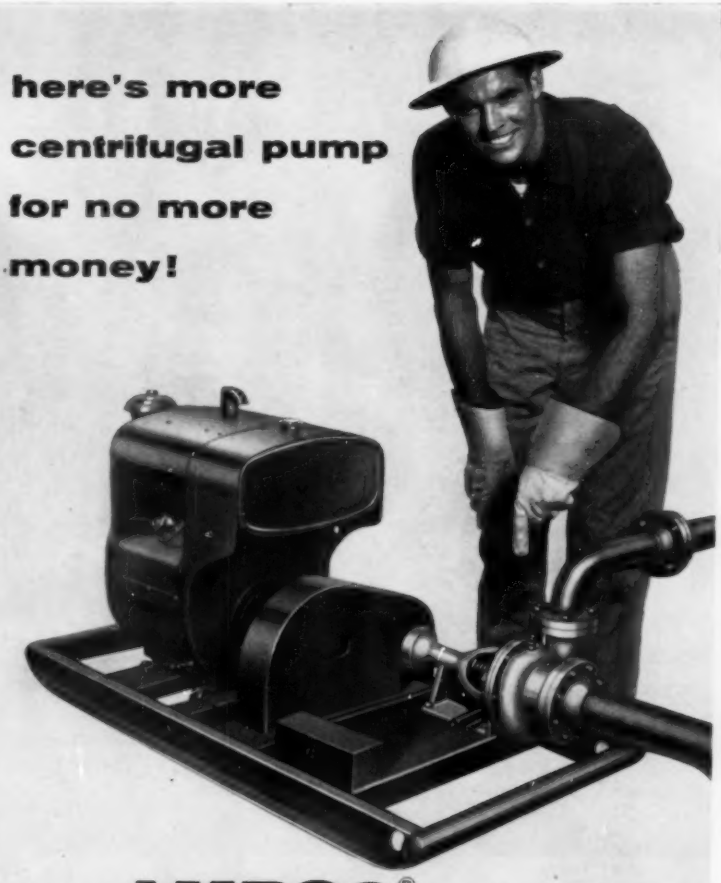
●

Weatherproof Meter Houses Catalog 10 gives specifications and construction features on the company's complete line of houses. These include Moran's standard, multidoor, horizontal, portable walk-in, utility, and indicating or recording types, as well as vertical-plant, custom-built, and cycling meter houses. The 12-page catalog is fully illustrated. The meter houses are designed to effect efficient and convenient instrument protection from all weather hazards, and insure against plant shutdown, excessive maintenance cost, and instrument freeze-up under severe weather conditions. **Write or call: Moran Furnace & Sheet Metal Co., 807 East Fifth Place, Tulsa 20, for Catalog 10.**

●

Access Fittings for Oil Well, pipelines, refineries, and other industries requiring means of entry into equipment under pressure are fully illustrated in new Catalog C-58. The 32-page, plastic-bound catalog shows cutaway views and tabulations of sizes and types of Cosasco access fittings for all applications. Detailed data are presented on fittings for obtaining pressure readings and those that permit valve removal or replacement

here's more centrifugal pump for no more money!



It's an AMPCO®
— available in aluminum bronze or stainless steel

It's engineered to resist velocity, erosion, and corrosion. Only Ampco gives you these special-pump extras at regular standard-pump prices:

Wear rings — to save the casing, prevent expensive repairs, reduce down-time.

Shaft sleeves—to give greater operating economy, eliminate worn shafts, cut your pump-maintenance costs.

These protective features keep you on stream, even under severe erosive and corrosive conditions. They are regular equipment on pumps carried in stock by your nearby Ampco Pump Distributor.

Bulletin P-3b tells more about Ampco Centrifugal Pumps in aluminum bronze, stainless steel, and other workable alloys. Send coupon for free copy.

Speeds, 1750 — 3500 rpm Capacities to 600 gpm. Heads to 300 feet.

AMPCO® THE METAL WITHOUT AN EQUAL

AMPCO METAL, INC., Milwaukee 46, Wisconsin
West Coast Plant: Burbank, California

AMPCO METAL, INC.
Dept. OGJ-2,
Milwaukee 46, Wis.

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P-3b

Campbell Chain

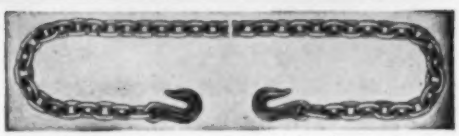
GOES BIG WITH ANY RIG!

"Measure-Mark" Chain

CAM-ALLOY and CAMPBELL HIGH TEST STEEL

Exactly marked every 5'. Color-coded for instant grade identification. Standard footage in every pack—color-coded labels with inventory control. **Cam-Alloy** features *extremely* high tensile strength—excellent resistance to wear—light weight for given load. Look for the *orange* "Measure-Mark." Campbell **High Test** Steel Chain is high-carbon steel, heat-treated for high tensile strength and maximum resistance to abrasion. Short links give maximum flexibility. Look for the *blue* "Measure-Mark."

BOOMER CHAINS



Made from Cam-Alloy or High Test Steel Chain with Grab Hook each end, 20 feet long. Supplied bright finish. Packed one chain in cloth bag. In dimensions and weights for every job.

WINCH LINE CHAINS

Made from High Test Steel Chain, heat-treated for increased resistance to wear and shock loads. Tagged for size and length. Bright finish. In dimensions and weights for every job.

TRUCK TIRE CHAINS

Available in 3 grades: *Lug-Reinforced* for maximum traction and wear, *Mud-Service* for off-the-road use, *Highway Service* for general use . . . single pneumatic and dual triple.

CAMPBELL CHAIN CAMPBELL CHAIN *Company*

Factories and Offices: **York, Pa.—W. Burlington, Iowa**

WAREHOUSES: Campbell Chain Company, 712 "R" St., P.O. Box #1144, Sacramento, Calif.; 3085 N.W. Front St., Portland 10, Oregon; Wald Terminal Warehouse, 902 Live Oak, Houston, Texas.

WEST COAST SALES MANAGER: D. R. Coutts, 1933 Mission Ridge Road, Box 1175, Santa Barbara, Cal.

TERRITORY MANAGERS: J. N. Kuhl, 7000 S. Shore Drive Hotel, Chicago, Ill.; S. Hardison, 1970 Val Verde, Germantown, Tennessee; S. Adsit, 17 E. 57th St., Kansas City, Mo.; A. E. Vincent, 3917 Thaxton Ave., S.E., Albuquerque, N. Mex.; K. Steinmetz, 1339 Sherwood Road, Glenview, Ill.; D. A. Ruffin, 5623 Boaz St.—Apt. #90, Dallas 9, Texas; G. W. Ferree, 5634 Putnam Drive, Birmingham, Mich.

CONTACT ANY OF THE CAMPBELL REPRESENTATIVES ABOVE FOR COMPLETE INFORMATION ON *ANY* TYPE OF CHAIN—OR HELP WITH A PARTICULAR CHAIN PROBLEM.

without system shutdown. Other applications show units for continuous internal-corrosion surveys, wet plugs for drill stems, tubing-suspension mandrels, crosses and tees, tubing heads, and Cosasco unitized wellheads for single or multiple completions. Also shown are the retrievers with which the fittings are worked regardless of pressures encountered. **Write or call: Cosasco Div., Perfect Circle Corp., 11655 McBean Drive, El Monte, Calif., for Catalog C-58.**

•

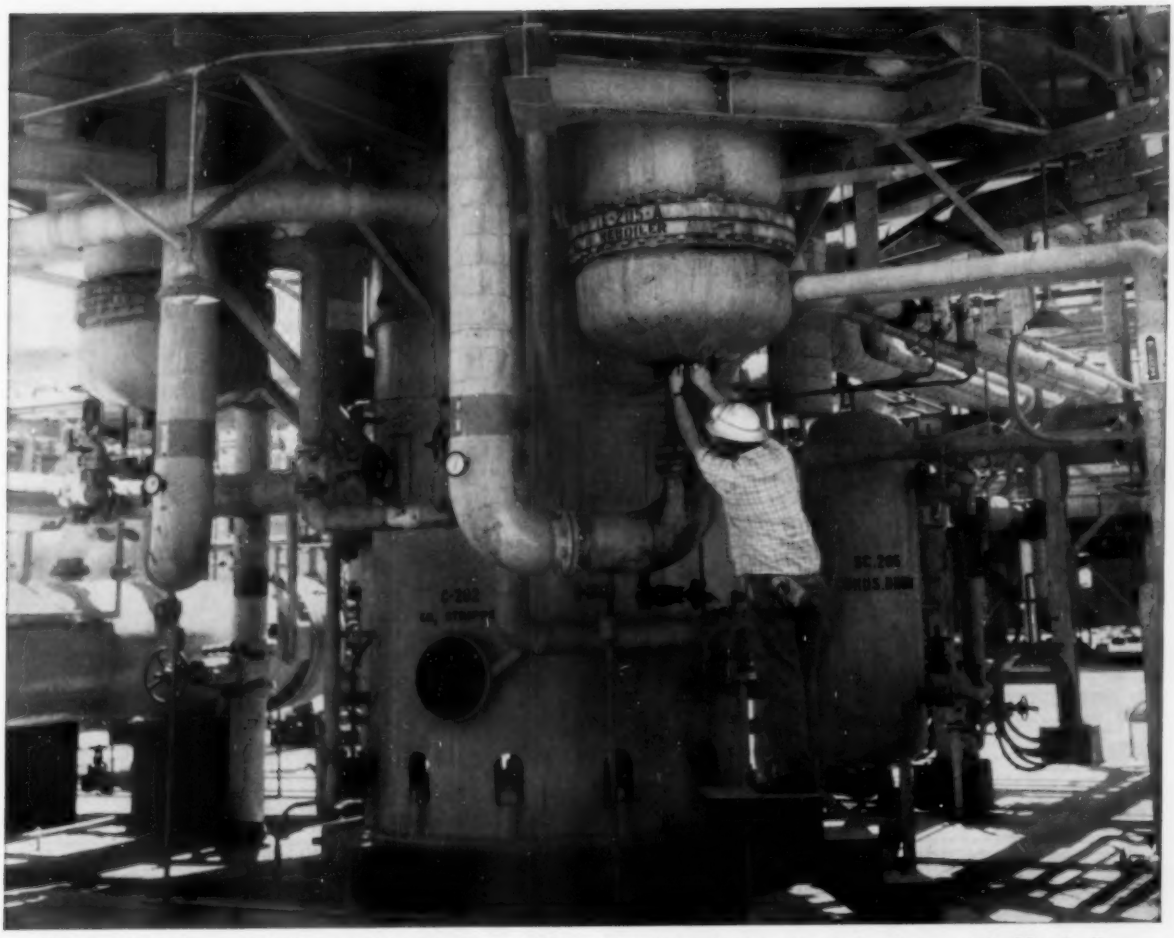
New Welded Steelcase Meters are described in three new bulletins—302, 303, and 304. The welded steelcase meters are said to combine all the time-tested design features employed by the company's displacement meters, representing a completely new approach to meter maintenance and retirement. Bulletin 304 gives technical information on the entire welded steelcase line, including meters with rated capacities of 75 to 300 c.f.h.., rated with 0.64 sp. gr. gas at ½-in. pressure drop and 5 psi. rated working pressure. Bulletin 303 gives detailed information on the W-75 we'ded steelcase meter which has a rated gas capacity of 75 c.f.h. Bulletin 302 describes the new W-45 LPG welded meter with rated capacity of 45 c.f.h. propane. **Write or call: American Meter Co., Inc., 920 Payne Avenue, Erie 6, Pa., for Bulletins 302, 303, and 304.**

•

Shot-Hole Portable Logger is described in new Bulletins B 58-1 and B 58-2. The logger is used to record electric and gamma ray logs to locate the optimum shooting depth, the maker reports. It features a well-reconnaissance, automatic, instantaneously developing, dry-process, photographic type of recording unit. It can be used for core-hole and strat tests, wildcat drilling, primary development, and secondary recovery. The bulletins contain the specifications for the logger—including depth capacity, log depth scale, and logging speed. Price lists for the logger are also given. **Write or call: Well Reconnaissance, Inc., 7818 Brook Hollow Road, Box 1483, Dallas, for Bulletins B 58-1 and B 58-2.**

•

Self-Fill Differential Collar is described in a new bulletin. The collar —placed in the string above the top float valve—permits well fluids to enter the casing through two side ports in the fillup collar while casing is lowered in the hole. Differential



Monel-protected . . . Reboilers on this column used for stripping CO_2 from monoethanolamine solutions at a Shell Chemical anhydrous ammonia plant contain Monel alloy tubes. Tubes have shown no significant corrosion in two years.

Little to do but turn the valves when MEA reboilers have Monel bundles

Shell Chemical checks CO_2 corrosion . . . descales only once in two years

This workman never had it so good.

Used to spend a good deal of time with the two reboilers on this column which strips CO_2 from "fat" monoethanolamine solutions. First he would dismantle one. Descale. Hook up again. Before long it was the other's turn. Every three to six months new tubes had to go in.

But that all stopped in 1954

Shell Chemical put in Monel* nickel-copper alloy tube bundles.

Since then, the reboilers have been descaled but once. What's more, deposits appear to contain no corrosion products . . . just stream precipitates. Tubes look like new . . . have never been replaced.

Take a leaf out of Shell Chemical's book

Inco's Corrosion Engineering Section will be glad to help you check into corrosive conditions within your MEA reboilers.

If Monel alloy is indicated for the tubes . . . and there's a good chance that it will be . . . put it in!

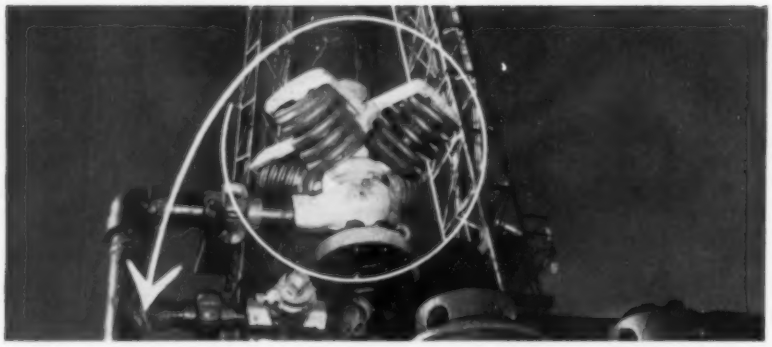
Then relax. Look at the meters. Turn a valve once in a while.

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK Nickel Alloys

Monel . . . *for minimum maintenance*



KINZBACH . . . Sensitive, Positive, Easily Adjusted Pressure Relief Protection

Operate rig circulation systems for maximum effectiveness — in complete safety — with Kinzbach Model 112 Mud Pump Relief Valves installed. You are assured instantaneous relief at set pressure with quick, automatic reset to maintain flow and pressure in partially blocked systems. When system is completely blocked, Kinzbach Pressure Relief Valves give full bypass for safety to pumps and other equipment.

Kinzbach Model 112 Pressure Relief Valve pressure range from 500 psi to 16,500 psi safely meets all drilling requirements including cementing and fracturing jobs. Available in 2" and 3" sizes. Write for complete catalog or see your Composite Catalog.

KINZBACH TOOL CO INC

KINZBACH TOOL CO., INC.
P. O. Box 277 • HOUSTON, TEXAS
EXPORT: 74 TRINITY PLACE, NEW YORK, N. Y.

SCRUBBER FACTS

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Purifiers • Scrubbers
Separators • Mist Extractors

For complete data on America's largest selection of gas scrubbers write for Bulletin 600. Here you'll find useful information on the types, sizes and pressures available on all kinds of scrubbers. Brief descriptions, applications and selection tables enable you to make purifier selections quickly and easily. Request Bulletin 600 from the V. D. Anderson Company, division of International Basic Economy Corporation, 1977 West 96th Street, Cleveland 2, Ohio.

ANDERSON Hi-eF PURIFIERS

See the Refinery Catalog

One Complete Dependable Source for Purifiers • Scrubbers • Separators • Mist Extractors

pressure, acting across a valve in the fillup collar, automatically maintains a near-balance fluid head both inside and outside the casing. The collar helps eliminate dangerous low-pressure areas which often promote blowouts, according to the maker. **Write or call: Halliburton Oil Well Cementing Co., Duncan, Okla., for Self-Fill Differential Collar bulletin.**

•

New Sure-Flex Couplings—suited to more than 150 different service applications—are described in new Bulletin 10100. Five tables short-cut the usual engineering calculations and give the answer quickly, taking into consideration the type of driver, horsepower, and r.p.m. as well as specific application. This patented flexible coupling consists of two flanges and a two-piece rubber sleeve, which lock together without clamps or screws. The product is designed to withstand all combinations of misalignment and end float, the maker says. And it will absorb up to 15° of torsional shock. **Write or call: T. B. Wood's Son's Co., Chambersburg, Pa., for Bulletin 10100.**

•

Liquid-Gas Separators are reviewed in new Bulletin 7-A. Within the unit, small microscopic liquid particles suspended in gas are trapped and filtered from the gas stream by means of a fibrous, resilient, inorganic filter element. They are retained in the filter medium until the particle size is increased by coalescing other small liquid particles, at which time the particle size is increased some 100 times. At this point, the enlarged droplet is forced through the filter by gas flow. The greatly enlarged droplet is trapped and separated by a knitted wire-mesh separator located in the gas stream from the liquid coalescer and filter unit. **Write or call: Perry Equipment Corp., Mineral Wells, Tex., for Bulletin 7-A.**

•

Aluminum Corrugated Jacketing Bulletin describes the aluminum jacketing in application with insulated pipe lines, vessels, towers, and tanks. Data on the jacketing and the addition of a moisture barrier are also included. Aluminels—made from 0.025 aluminum which gives additional strength at the ells—are described. Other company products are discussed in the bulletin too. **Write or call: Preformed Metal Products Co., P. O. Box 1134, Shreveport, La., for Aluminum Jacketing folder.**

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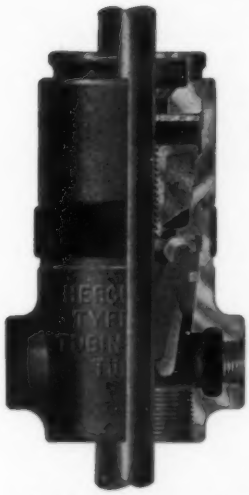

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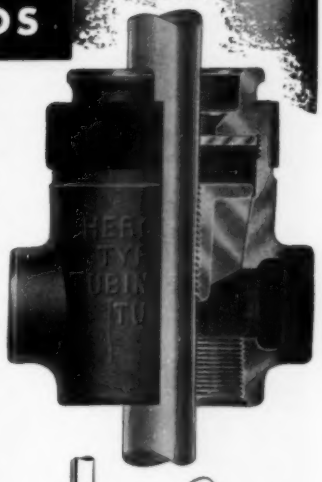

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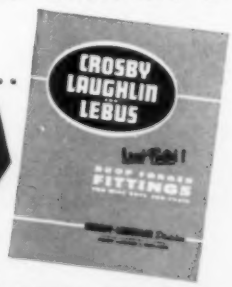

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EQUIPMENT MEN

Nordberg Appoints Dow to Head New York Office . .

H. W. DOW, JR.

succeeding A. R. McMullin, who has retired after serving as district manager since 1936, according to Robert E. Friend, president.

H. W. (Herb) Dow, Jr., joined Nordberg as a production engineer in 1943 and entered sales engineering in 1945. He advanced to district manager for the mideastern territory of Nordberg Manufacturing Co. and served 2 years as staff assistant to R. W. Bayerlein, vice president in charge of the engine division at Milwaukee. Since 1955, Dow has been a special representative of the engine division in the New York office.

Seaton, Luetzow Named to Wolverine Tube Posts . .

as technical sales supervisor and technical sales representative, respectively.

Ralph Seaton will be responsible for the sales of Wolverine heat transfer products to the oil and chemical industries, according to A. R. Kaspark, manager of technical sales for Wolverine Tube, fabricating division of Calumet & Hecla, Inc. Howard J. Luetzow replaces Seaton as technical sales representative serving the New York-New England areas, according to F. F. Moore, eastern district sales manager for Wolverine.

Seaton will headquarter in Wolverine's new administrative offices in Allen Park, Mich. Formerly technical sales representative in the midwestern sales district, Luetzow will contact petroleum, petrochemical, chemical companies and heat exchanger manufacturers and fabricators.

W. D. Johnson Chemical Labs Appoints Goff . .

as sales engineer for its newly established Rocky Mountain territory.

James Goff has been sales engineer for W. D. Johnson Chemical Laboratories, Inc., in California's San Joaquin Valley for the past 4 years. Bill Swearingen, Goff's assistant at that location, will take over the San Joaquin Valley area.

Platt Brothers Offers to Buy Rest of Le Grand Stock . .

according to D. B. Mirk, chairman of the board of Le Grand, Sutcliff & Gell, Ltd., British manufacturer of industrial equipment. Platts had, in February 1957, purchased a substantial part of Le Grand ordinary shares. The offer to purchase the balance of ordinary shares does not include preference shareholders, and if accepted will make Le Grand a wholly owned subsidiary of Platts.

Platt Brothers & Co. (Holdings), Ltd., is owner of many other companies, particularly in the textile industry. Its holdings are principally in England. The merger of Le Grand into the Platt group will provide additional financing for expansion planned by Le Grand.

National Supply Modernizes Oklahoma City Store . .

to improve services and facilities and to give an over-all resemblance to the company's oil field supply stores. At present National Supply Co. operates 131 stores in the United States, Canada and Venezuela. The Oklahoma City store has been in operation since 1929.

Wayne Showalter is store manager, under supervision of W. M. Jones, Oklahoma City district manager.

Houston Bank & Trust Co. Names Mission's White . .

to the board of directors. Richard E. White, president of Mission Manufacturing Co., joined the firm in 1938. He served as executive vice president before becoming president in December 1957.

Axelson Manufacturing Co. Appoints Evans, Ramey . .

to the respective posts of general sales manager and assistant to the president. According to James F. Beré, Axelson president, the appointments

L. G. EVANS

K. S. RAMEY

of Lester G. Evans and K. S. Ramey are expected to strengthen Axelson's position in the petroleum field. The recent reorganization in which the Axelson machine tool and aviation departments were assigned to other USI divisions makes the firm exclusively a petroleum equipment manufacturer.

Evans was formerly vice president and general manager of the All-Power Manufacturing Co. Prior to that time he served with Emsco Manufacturing Co.

Gasche Talks on Supplier-Contractor Relations . .

at the Association of Oilwell Servicing Contractors convention held in Dallas last month.

Louis M. Gasche, vice president of Fred E. Cooper, Inc., told the group that since servicing contractors contribute to the support of suppliers and manufacturers, it behooves the contractors to be concerned about suppliers' functions insofar as they relate to the contractors' operations.

Gasche told the contractors that "suppliers must avoid having excessive amounts of slow moving inventory which imposes additional overhead on all items if the operation is to show a profit."

He suggested that suppliers could serve contractors better if contractors could anticipate requirements

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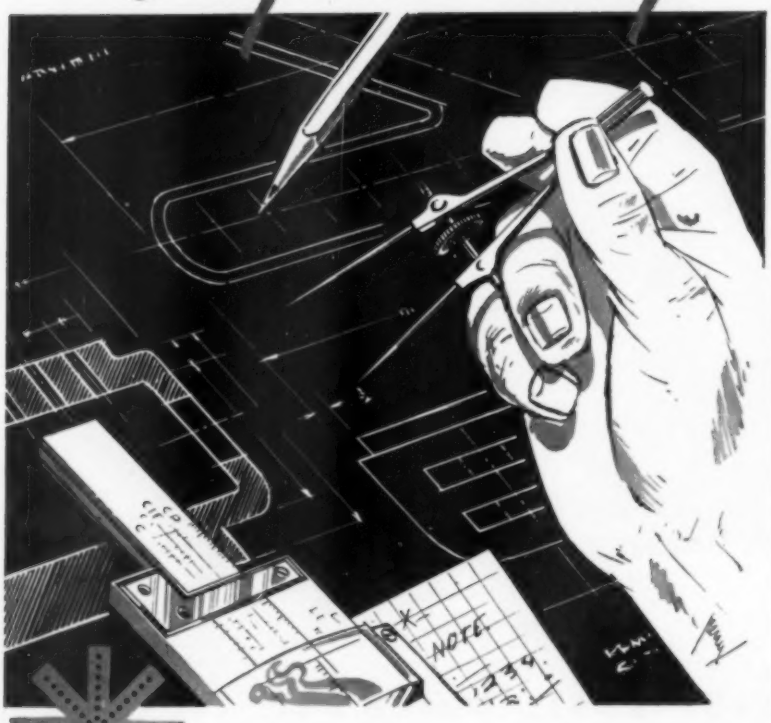

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in advance, particularly on items that do not wear out abruptly. "Emergency parts orders entailing long distance calls, often air transportation, or long drives to get the material to the location can result in handling costs in excess of the value of the material involved. In the end, you pay these costs," the contractors were told.

Jones & Laughlin Supply Names Field Salesmen . .

upon completion of their program as sales trainees, according to W. L. Wolfe, vice president of sales.

L. K. Greer, who has been in training at the Borger, Tex., store, is now assigned as a salesman at that store. D. R. McKown has been assigned to the Williston, N. D., store. McKown has been training at the Perry, Okla., store. J. W. Payne is assigned to the Lindsay, Okla., store, where he has been training.

J. N. Ryan, who has been training at the Laurel, Miss., store, has been named as a salesman at that point. H. L. Shackelford is assigned as a salesman at the Odessa, Tex., store. He has been in training at Victoria, Tex. C. H. Warren, Jr., is assigned as a salesman at the Sundown, Tex., store where he has been training. D. R. Williams is assigned as a salesman at the Snyder, Tex., store where he has been in training. C. S. Wood is assigned as a salesman at the Odessa store. He has been training at the Carmi, Ill., store.

Johnston Testers Appoints Flanagan, Graham . .

as manager of field operations and personnel manager, respectively.

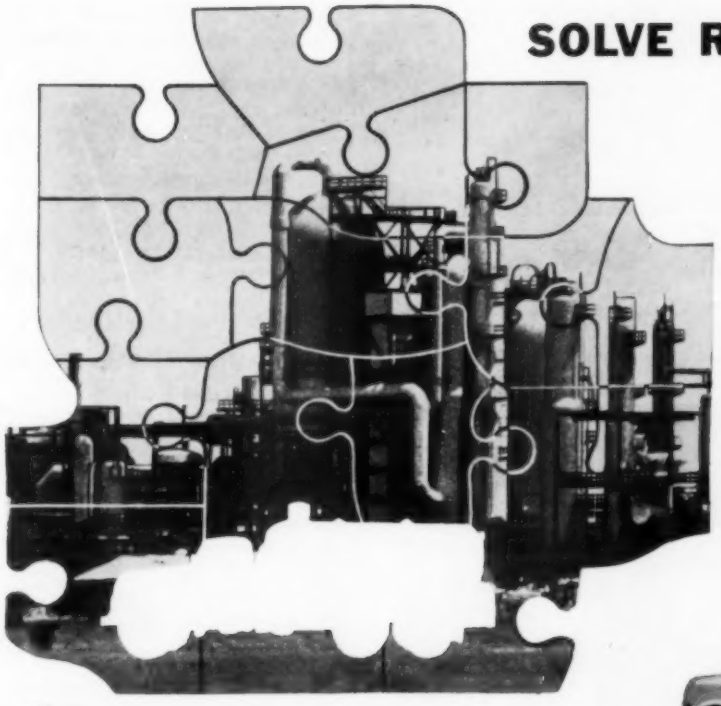
Other new assignments include

J. FLANAGAN

BOB GRAHAM

Lastie Paul Vincent, Jr., as technical assistant to the manager of field operations, and Buddy R. Dixon as administrative assistant to the manager of field operations.

J. H. Flanagan joined Johnston Testers, Inc., in 1942 as a field tester. In 1946 he was promoted to export manager and in 1955 was named Canadian resident manager in Calgary. He served there until early 1957, when



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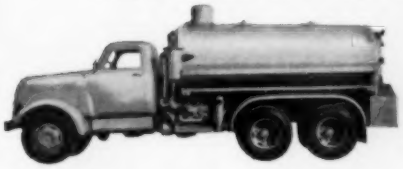

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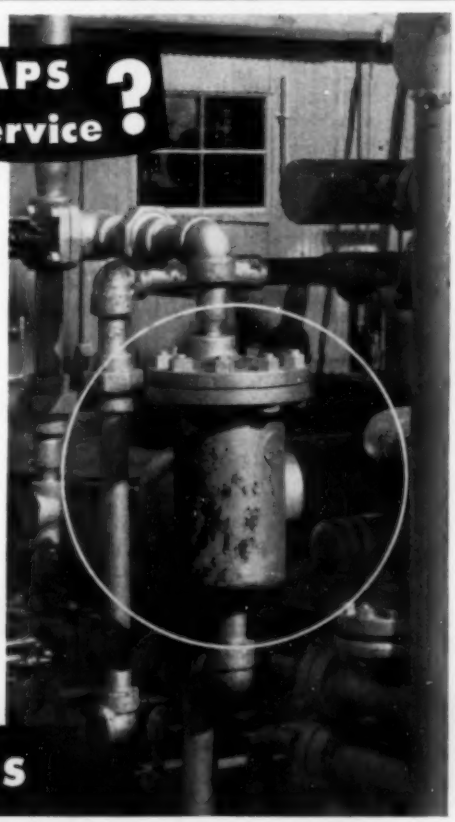

ARMSTRONG STEAM TRAPS

he was appointed personnel director. As manager of field operations, Flanagan will coordinate all field activities including testing, perforating, transportation, inventory, and budgets.

Bob Graham was appointed personnel assistant in July 1957 and has served in that post until his recent appointment. Vincent has been with Johnston since October 1957. Previously he was with Schlumberger 6 years. Dixon, a member of the Johnston organization 3½ years, was assistant sales manager before his present assignment.

Crane Names W. O. Brown General Sales Manager . .

with headquarters at the company's general office in Chicago. According to Neele E. Stearns, president, Brown will coordinate sales activities, as well as the marketing research and advertising promotion departments.

Brown has been district manager with headquarters at Los Angeles since 1954. From 1950 to 1954 he was manager of Crane Co.'s plumbing sales department, Chicago. He joined the company in 1930 at its Washington, D. C., branch. Brown was named assistant branch manager there in 1943 and later became sales manager. In 1946 he was promoted to the managership of Crane's Richmond branch, a post he held until moving to Chicago in 1950.

Stearns also announced the resignation of J. W. Greene, vice president for sales. Greene was elected to the vice presidency in May 1957 after 21 years in the company's sales activities.

Schlumberger Names Doh as U. S. Representative . .

C. A. DOH

for its foreign subsidiaries. Schlumberger Overseas, S.A., operates in the East and Far East; Schlumberger Surenco, S.A., in South America; and Societe de Prospection Electrique in Europe.

Charles A. Doh joined Schlumberger Well Surveying Corp. in 1934 and worked in various locations in Rumania, Venezuela, Texas and Illinois. He served as Illinois division manager from 1945 to 1951, moving to New Orleans as manager of the Southwest area. In 1956 Doh was transferred to Houston as manager of customer relations. He will continue to headquarter in Houston.

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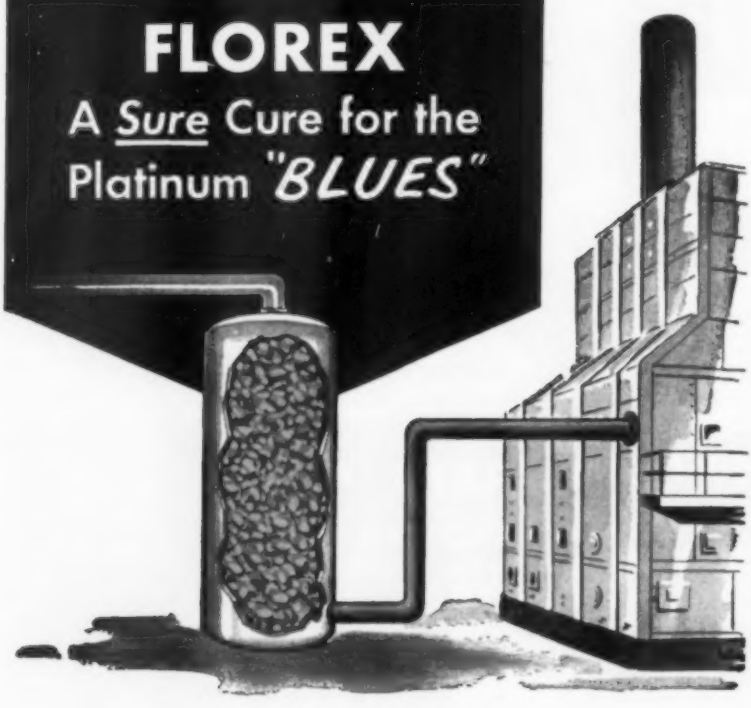

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H. C. Smith Oil Tool Co. Elects President . .

at a recent meeting of the board of directors. Herschel C. Smith, shown here with H. C. Smith (left), was elected president. H. C. Smith, founder and previous president, was named to the newly created position of chairman of the board of directors.

Herschel C. Smith, who has been with the company since 1936, was made general superintendent in charge of production in 1943 and became secretary and general manager in 1945. He was elected vice president and general manager in 1953 and in 1955 became executive vice president.

Rector Well Equipment Holds Annual Sales Meeting . .

at the company's general offices in Fort Worth. J. L. Pinkard, sales manager, presided at the meeting.

L. L. Rector, president, addressed the meeting and announced that the company is installing IBM equipment for high speed electronic accounting, billing and inventory control. John L. Curry, manager of the cementing equipment division, presented three new products which the company is currently putting into production. J. D. Sloman, sales engineer, discussed development work on a back pressure valve and lubricator for use in dual string assemblies which Rector plans to put on the market in 1958.

Shown are, left to right, front row: James Moore, R. B. Yanaway, J. L. Pinkard, J. D. Sloman, M. O. Andrews, C. W. Zartman, R. V. Evridge, W. P. Knight, L. L. Rector, M. C. Davis, C. L. Cron, A. J. LaBate, John L. Curry, J. W. Myers, R. R. Rector, W. R Tipsword, J. W. Freeman.

Second row: George Hitzfield, Marvin Sargent, J. B. Fanning, Grady L. Cooper, Paul L. Kittrell, J. R. Pinkerton, Edna Lacy, Winnifred Roberts, Barbara Cozby, Virginia Jarvis, Joyce Spears, Frances Grizzle, J. I. Thomas, M. J. Hunter, John H. Horton, Howard Ray, Gordon McHaw.

Third row: F. S. Malone, Bernice Woolsey, Ray Layne, C. L. Splawn, Frank Blanton, Paul G. Honeycutt, George Stewart, Gene Beaupre, Sam Beavers, Ray Goodnight, William R. Singletary, Tom J. Dacy, J. I. Norton, T. C. McDonald.

Alco Products, Inc., Appoints Two . .

in connection with the opening of the diesel-electric power package assembly plant at Beaumont, Tex. W. R. (Bill) Jones has been named product supervisor, diesel-electric power package, and Thomas A. Gallagher is now project engineer for drill rigs and oil field equipment.

Jones joined Alco in 1956 as a field service engineer on diesel-electric rigs and in May 1957 was made a sales engineer. Gallagher joined Alco as a service engineer on diesel-electric locomotives. He was transferred to Beaumont in 1956 as assistant to the chief engineer of research and development.

Shell Oil Co. Awards LACT Contract to Graver . .

for five batteries to be installed on leases in Grayson County, Texas. The five leases are in an area of North Texas which has been producing from a large number of wells into central batteries of tanks. These will be replaced by the new equipment. The new batteries will receive lease production and automatically gage, sample and completely record production, then turn it into pipelines, making manual attention unnecessary.

All equipment will be furnished and installed by Graver Tank & Manufacturing Co.'s oil and gas equipment division, with completion and testing scheduled for early 1958.

J. M. Temple Heads New Foxboro Sales Region . .

J. M. TEMPLE

in the Rocky Mountain area. From headquarters at Denver, Temple will supervise Foxboro Co.'s branch offices in Denver, Salt Lake City, Kansas City, and Omaha, formerly administered through the regional office in Chicago.

Foxboro has also opened a new branch office in Denver and appointed Paul C. Jones as sales engineer for the Denver area.

Temple was formerly plant manager of Glen Rose Gasoline Co., Houston. He is experienced in industrial instrumentation, having served as manager of the Baton Rouge and Houston offices since joining Foxboro in 1949. Jones has been a sales engineer with Foxboro's Chicago and Indianapolis offices since 1954.

The new regional office in Denver gives Foxboro 11 regional divisions and 59 branch offices.

Bethlehem Names Nowlin to New Denver Division . .

as resident sales manager. The Denver district sales office has become a division sales office, comparable to other Bethlehem division sales offices at Houston, Dallas and Fort Worth, Tex. Both W. A. Nestlerode and H. B. Karstetter will continue their headquarters in Denver. Nestlerode will become a special division sales representative on machinery and waterflood projects, and Karstetter will become a division sales representative, assisting L. V. Nowlin in contacting oil companies, operators and contractors in the Denver area.

Nowlin formerly was local representative at the Dallas, Tex., division sales office.

BJ Tools, Inc., Appoints European Sales Manager . .

J. P. MAGOFFIN

to facilitate sales of all BJ equipment and to bring a closer relationship with its customers in Europe and the Middle East. J. P. Magoffin has been named to the new post, according to Garth Nicolson, vice president and general manager of Byron Jackson Tools, Inc.

Magoffin, who has been with BJ 15 years, was sales manager of the Patterson - Ballagh organization (PB rubber products) at the time it became part of Byron Jackson. He opened and managed the first Mid-Continent office that combined the products and services of the two organizations. He later was the first regional manager of the Rocky Mountan and Canadian territories. His most recent position was as new product sales manager.

Initially, Magoffin will have headquarters at the United Kingdom, offices of Borg-Warner Corp., BJ's parent company, in London. In the near future he will establish offices on the continent to contact operators of drilling and production companies.

Welex, Inc., Makes L. F. Drake Division Mgr. . .

of its new Oklahoma division. The division includes districts in Ardmore wth H. L. Humphrey as manager; Bristow, M. F. Rockwell in charge; Oklahoma City and Pauls Valley, B. D. Nation as manager, with his office in Pauls Valley; Pawhuska, M. W. Power as manager; Shawnee

NEWS!

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Just one amplifier. You change its service by switching service cans. Both the amplifier and the transducer plug-in . . . means minimum instrument down-time for service. Also means low instrument inventory because you only need one spare amplifier.

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Check these additional benefits: • Infinitely sensitive to input signal. • High order of linearity and accuracy. • No moving parts such as slidewires, batteries, or standard cell. • Continuous vernier range adjustment. • Continuous vernier zero or suppression adjustment. • Convenient front panel checkout and adjustment. • Printed circuit, for completely uniform performance. • Thermocouple burnout protection, either up or down scale.

Acknowledged by users as the finest instrument of its kind on the market, the TRANSET Potentiometer is ideal for processes permitting the use of pneumatic receivers and controllers, whether large case or miniature. Its outstanding flexibility permits a narrow or wide range span according to process demands.

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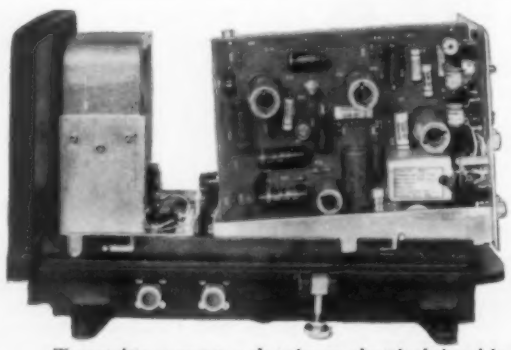

Transmitter converts a dc primary electrical signal into a 3-15 psi pneumatic output for controllers and receivers.

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with R. L. Vanderslice as manager; Stillwater with Charles Rothwell, Jr., as manager; and Woodward with B. G. Taylor as manager.

Other division personnel include Harold Wolverton, assistant division manager; R. B. Burns, division sales manager; G. R. Short and G. K. Harcourt, division sales engineers, all of Tulsa; and J. W. Sherwood and G. C. Thomas, Jr., sales engineers in Oklahoma City.

Tretolite Co. Assigns C. D. Krieg to Houston . .

to carry on liaison work of field to the central research and development program. Krieg will devote much of his time to special services in refinery problems.

Krieg succeeds Ed A. Baumstark, who recently was appointed assistant to L. A. Bainter, Jr., manager of the southern division.

Regional Sales Meet Held By Drilco Oil Tools . .

at Midland, Tex., for promotion of sales and indoctrination of Drilco products and services. Representatives came from the following areas: Rocky Mountain, Four Corners, Kansas-Texas panhandle, Oklahoma-North Texas, North Texas, Ark-La-Tex, Louisiana Gulf Coast, Texas Gulf Coast. The division manager from the Gulf Coast and eight representatives from the Midland office attended the meeting.

Bill Bachman, sales manager, presided at the meeting with Stanley Moore, president of Drilco Oil Tools, Inc., giving the welcoming address. Other talks were given by Moak Rollins, production and engineering manager; Bill McCutchen, general office manager; and Bill Garrett, research engineer.

Shown are (left to right) Glen Chance, Ark-La-Tex representative, Shreveport, La., with highest sales volume in drill collars per month; J. M. Wigley, Rocky Mountain representative, Casper, Wyo., with largest total volume of stabilizer sales; and Bill Bachman, sales manager of Drilco.

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The revolutionary Rex system of pitch control assures equal load distribution over all parts, and a special Rex manufacturing process imparts tremendous extra strength at the pin holes—both important factors in long chain life.

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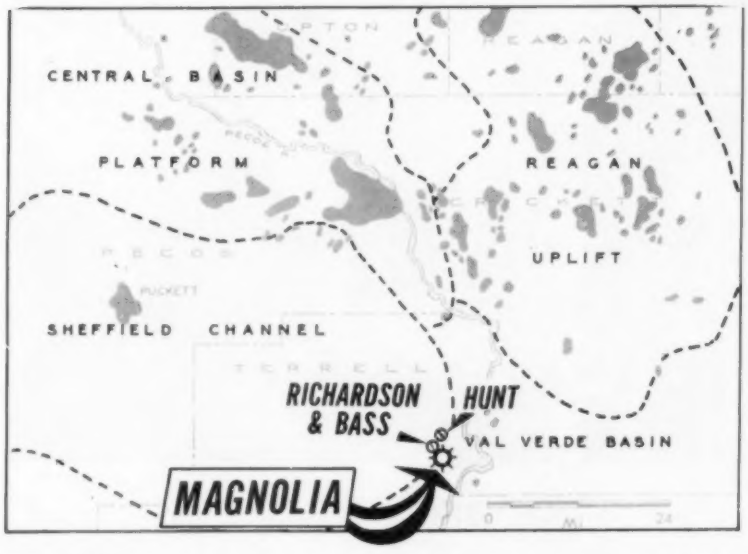


NEW INTEREST in deep pre-Permian reservoirs of the Val Verde basin of West Texas has been stimulated by dual success at Magnolia Petroleum Co. 1 Brown Bassett in Terrell County. Discovery has flowed commercial gas from both Silurian and Ellenburger.

Val Verde offers 1,600 ft. of Ellenburger to shoot at

and West Texans polish up their shooting irons

BY FRANK J. GARDNER

ONE OF WEST TEXAS' most spectacular recent discovery wells is now nearing completion in northeastern Terrell County. Magnolia Petroleum Co. and Western Natural Gas Co. 1 Brown Bassett, in Section 218, Block Y, TCRR Survey, was in the headlines last summer when it blew out at 12,407 ft. while drilling in the Silurian. Later in the year, it was back in the news when commercial flows of gas were found in an Ellenburger section more than 1,600 ft. thick.

Today, the 1 Brown Bassett is testing for commercial gas completion in the same section from which it blew out, the Silurian at 12,387-12,446 ft., as well as from several sets of perforations in the Ellenburger. On latest tests, the well flowed 9,245 M.c.f. gas daily on 20/64-in. choke from Silurian and 14,100 M.c.f. on 24/64-in. choke from Ellenburger at 14,120-86 and 14,214-90 ft.

A tiger by the tail . . . When this wildcat blew its top last August, it swallowed up a $450,000 derrick and all the works. At the time, Magnolia declared that it ". . . may be a good thing if it makes some people realize the risks taken . . . in looking for new fuel supplies." But the company knew it had a tiger by the tail, and went back into the hole after successfully capping the blowout. The discovery of the thick Ellenburger section was a partial reward, and the Silurian reservoir (first in this part of West Texas) is the perseverance bonus. On the way down, the bit penetrated the Wilberns-Cambrian formation and bottomed in the Precambrian at 15,556 ft. Operator set 5½-in. casing all the way to total depth.

With surface elevation of 2,448 ft., the 1 Brown Bassett topped the Strawn-Pennsylvanian at 11,435 ft., Mississippian at 11,540, Woodford-Mississippian at 11,584, Devonian at 11,920, Silurian about 12,400, Simpson-Ordovician at 12,562, Ellenburger at 13,742, Wilberns at 15,365, and Precambrian at 15,445 ft.

In an ancient seaway . . . This deep success in the far-flung ranch country of southwestern Texas lies at the eastern outlet of the Sheffield channel, an ancient seaway believed to have connected the Delaware basin on the west with the Val Verde basin on the east. It is the first Silurian strike in the region. Previously, Pennsylvanian gas had been found at 5,600 ft. on the Goode and Hoge ranches, 2 miles to the southeast of the new discovery. The only other production in Terrell County is at Spencer field, a small gas pool 20 miles to the north; this is a Lower Permian reservoir.

But across the county line in Val Verde County, Magnolia had another Ellenburger discovery at Morrison field in 1956. This one flowed 1,250 M.c.f. daily from 14,000 ft. And between Morrison and the 1 Brown Bassett, Crockett County's Pandale discovery in 1953 was an Ellenburger producer at 13,808 ft. In southeastern Crockett County lies Pierce field, with Ellenburger gas at 11,800 ft. All of these deep strikes are indicative of things to come in the Val Verde country.

Two more wildcats are on the way down in Terrell County, not too far from Magnolia's new success. These are Hunt Oil Co. 1 Bustin Canon in Section 5, Block 1, TCRR Survey, and Richardson & Bass 1 Goode in Section 6, Block R. TCRR Survey. The Hunt test is fishing at 15,000 ft. now, while Richardson & Bass are digging ahead near the 10,000-ft. level.

Extends a challenge . . . This serious new interest in one of Texas' least-explored corners is a heartening development. Undoubtedly, many other fields of the caliber of Pecos County's Puckett field lie hidden in the pre-Permian rocks of the Val Verde basin. It will take deep drilling and dogged persistence to find them, but with 1,600 ft. or more of Ellenburger to shoot at, West Texans can be depended upon to meet the challenge.

Science . . . or art?

What is oil-finding talent?

THE AUTHOR SAYS: "When oil is found, excitement is high and prejudice is strong for the assignment of credit. The same is true under the duress of escaping responsibility for dry-hole failures. It is no wonder that the science of geology has become somewhat segregated from the art of oil finding and that the science has become an accessory to the art."

BY MAX R. MOTT
Consulting Geologist, Denver

IT IS OFTEN said in the industry that "oil finders are not necessarily well-trained geologists." This is not to say, of course, that the reverse is likewise true.

Geologists, well trained to find oil, have indeed found a great deal of oil —some of the most important reserves known today. Other well-trained geologists seeking oil have failed to see, or have been unable to use, the right combination for success.

The reasons for misapplication or nonapplication (and the attendant misunderstanding) of the science of geology in oil finding are numerous. Many individuals and operators have successfully found oil without the benefit of technical staff or even a single geological advisor. Further, in a given province of exploration the number of geologists on an operator's staff does not always correlate with the volume of oil found.

Newsworthy, of course, are the dynamic men of little or no technical background who have constantly placed themselves or their companies in areas where oil was ultimately discovered.

Science of geology oversold . . . Over the years, geologists in general have been inclined to present themselves to the oil industry as the scientists who are qualified to assist in the search for oil. Early recognition was not won easily. Subsequently, it may even appear that the petroleum geologists oversold their science, overdeveloped an expectancy of results. The professional enthusiasm in some cases perhaps overcarries.

Now geologists are apt to be found doing almost anything and everything in the exploration effort, except managing the really critical decisions. Responsibilities in some cases have been reduced and relegated to "duties." technical in pattern. Well sitting, evaluation reports, map posting, and stratigraphic plotting are apt to be done almost mechanically because they are "jobs that have to be done." Management may fail to pay much attention, and the incentive to think is lost.

Bureaucracy thrives in such an environment. If they are not mindful, the geologists may crowd together in self-defense, and in defense of their science. Very logically, a tendency to insulate themselves against the "babel" of geological tongues may arise among those who manage. There isn't time to listen to it all. It can be only understood. Management says rightly, "We must act, or be left behind."

It seems that managers are the artists and must sprint ahead of the scientists to stay in the competitive race for new discoveries. It may even seem that mere scientists are not expected to be capable of decisions concerning over-all exploration strategy.

Before we criticize the "artist" man-

This article originally appeared in The Mines Magazine, official publication of the Colorado School of Mines Alumni Association.

ager, it may be wise to study a definition of art, found in a good dictionary, which is: "knowledge made efficient by skill." Skill may be strong, even where knowledge seems brief.

Oil finder . . . The oil finder needs examination. If he deserves the title, he consistently finds oil at a profit for his company or for himself. He may have almost any background. If he is a farmer, landman, lawyer, engineer, geologist, or tool pusher, chances are that he has been reasonably successful in his vocation because he uses his head to good advantage. If he has the ability to find oil consistently, he is not dumb, and was not dumb to start with. Whatever his training has been, if he finds oil a man can "do no wrong," and for practical purposes, his training is equivalent to the best in the world.

During the early stages of the current Denver basin activity, the writer became acquainted with a farmer who showed qualifications as an oil finder. This individual farmed uutil the oil play entered his home county. He had a natural curiosity, so he struck acquaintance with the oil people who moved into his community.

He plied them with questions about their business. He visited almost every wildcat well drilling in the area in order to learn the lingo and the business. Curiosity developed into zeal, the man soon figured he had learned enough, and he had the courage to compete actively with the numerous oil companies operating in his neighborhood. Being well acquainted, he gan "horse-trading," buying and selling leases. This led to promoting wells.

In a remarkably short time, the farmer had production in several different oil fields. He could be considered a successful "oil man." He had competed successfully with companies who retain large staffs trained specifically in oil finding. This individual had above-average intelligence, but other attributes appear to have been involved.

First, the farmer had natural curiosity. He satisfied it by investigating as much of the oil business as came within his range.

Second, he learned by observation. In his part of the country, he learned under what conditions oil occurred and was found.

Third, by continued and projected observation, he reasoned where similar conditions for oil might occur.

Fourth, he applied his knowledge. He obtained leases on the land which seemed most obviously favorable, and they brought him considerable wealth.

This sequence of events will not happen for every farmer, or even for a significant percentage of farmers. Probably, a majority of all farmers would like to have a crack at it, but few have both the courage and the time. Though he represents a very small minority, the successful acquaintance demonstrates a principle.

Probably the most important thing this man did was to apply the knowledge he had in his search for oil. He had only a rudimentary knowledge of the oil industry, and his knowledge of geology was very rough. He didn't know a marine sand from a continental sand, and he didn't know what a "structure" was. But he learned through observation where oil might occur. And he used that knowledge. That he is an oil finder is not disputed.

"From the practical point of view, the selection of heroes in the geological profession may be subject to mistaken identity . . . in other words, our professional societies are prone to honor the accumulation of knowledge."

Petroleum geologist . . . Next, the petroleum geologist deserves examination—to see where or how he may differ from the farmer oil finder. This man too has a natural curiosity, which is why he took up geology in school. Men who enter scientific study for the most part are avid to gain more and more knowledge without limit, to learn and learn and learn.

A petroleum geologist working in a given province has much to learn if time avails. He is expected to learn and is given the opportunity to learn under what conditions oil is trapped in this environment. He is given the equipment and the help to determine where optimum conditions prevail. In this he has more strength than the lay oil finder. Where he suffers, however, is apt to be in the application of his knowledge, where time is important.

The geologist very often wants to learn more, to gain more knowledge, before he recommends a certain prospect to his company. Not infrequently, by the time the additional knowledge is available to the geologist and his company, the oil finder who travels light has already leased, drilled, and discovered oil on the prospect. About all the geologist can do at this juncture is shake his head and muttter something like "I thought there was oil there, but I couldn't be sure."

This tendency of geologists to wait for additional information before venturing a firm recommendation is largely due to scientific training. The scientist is trained to have all pertinent data at hand before drawing a conclusion. The geologist is thus likely to be too late with his recommendations. Some other operator or individual, who "didn't know enough not to," will be apt to grab the deal and make a discovery. The mature petroleum geologist must learn to sacrifice perfection in science and exercise his best judgment on scientific approximations within practical limits.

The comparison of the oil finder and the geologist may suggest some improvements in the training of the petroleum geologist in perspective. The very nature of the business requires a different perspective than is usually received by the trainee geologist.

The geologists' profession will have to learn to move swiftly with the trade. There is nothing to prevent the unidentified oil finders from rushing after their hunches, in complete disrespect of science. They'll muddy the water and move on. They get in and out of many ponds with little effort, and their discovery percentage has been good enough to make it worth while to them and embarrassing to the geologists.

To improve their standing in service to the company and the industry, geologists must learn to work on an emergency basis where every moment counts. They must learn quickly to discriminate between the vital and the accessory geological investigation, and when time permits indulgence only in the vital.

Who's who? . . . From the practical point of view, the selection of heroes in the geological profession may be subject to mistaken identity. There is a proper tendency on the part of students in school to feel and show respect for the academic leaders who have amassed a great deal of learning.

This achievement of broad knowledge is to be admired during school and after. It is helpful, and often referred to by the industry. It is not necessarily true, however, that this great breadth and depth of knowledge will find oil effectively enough under present circumstances.

It may be indirectly responsible for inspiration, cultivation of curiosity,

(Continued on page 199)

IN NIOBRARA COUNTY, WYOMING, the acid-oil emulsion used in Acid Petrofrac gives excellent results in the first Leo sand at about 5400 feet. 5000 gallons of this emulsion is generally recommended for pays 50 to 75 feet thick. The treatments usually cost less than $3000. Some have resulted in 100 bopd production. Payout is often less than ten days.

ACID MAY BE YOUR BEST WELL STIMULATION "BUY"

Inhibited acid has long been one of the most effective fluids for stimulating production from oil and gas bearing formations. Many thousands of wells have been brought in as healthy, high-profit producers through its use. Often inexpensive, small-volume acid jobs have given outstanding production increases.

Today, acid is even more effective—because of the application techniques and the acid addition agents developed through Dowell research. When you have a well stimulation problem, it makes sense to *consider the use of acid first*—by itself or in conjunction with a fracturing treatment. Acid is proving to be the most versatile of all well treating fluids.

For example, acid is no longer confined to just the highly soluble formations like limestone and dolomite. Conglomerate, chats and some sandstones frequently contain appreciable amounts of soluble materials. Dissolving these deposits is often the best way to increase permeability and ultimate recovery. Also, the highly soluble limestones that previously required constant attention and frequent reacidizing, can now be treated with Retarded Acid to help get deeper penetration and extended drainage areas.

Mud Acid, Stabilized Acid, Silicate Control Acid, Channeling Acid, Acid Petrofrac®, Breakdown Acid —and a host of other Dowell tailored acid services and acid-base fracturing services—are helping unlock problem formations that heretofore were unprofitable.

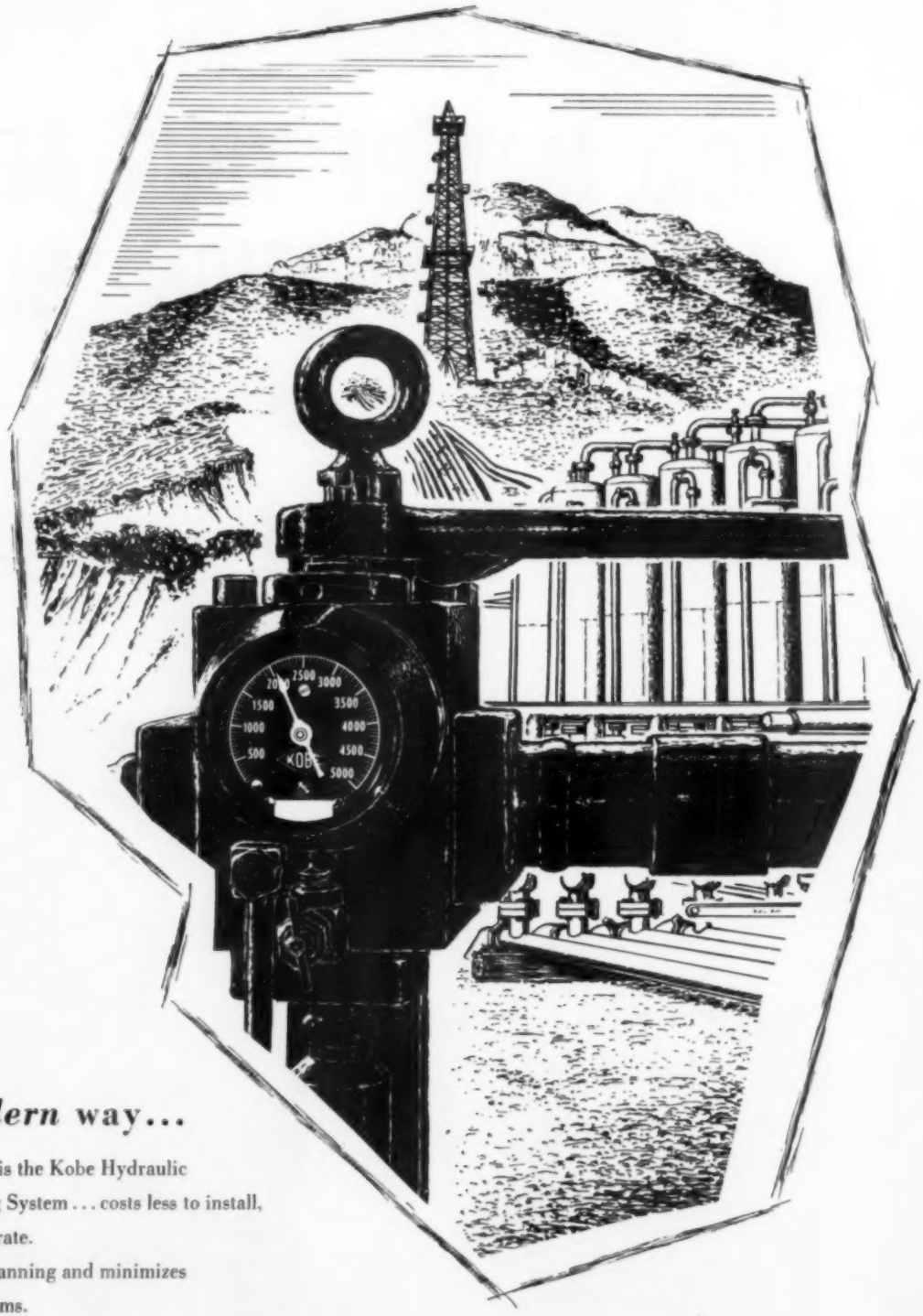
When faced with a treating problem on either a new or an old well, consult your Dowell engineer. Let him help you decide on the best treatment. Take advantage of the 25 years' experience of the people who *first* brought acidizing to the oil fields. Call any of the 165 Dowell offices and stations in the United States and Canada. In Venezuela call United Oilwell Service. Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

IN RED DEER, ALBERTA, CANADA, the highly-soluble Sundre Mississippian lime responds well to a specially-tailored Dowell acid. Preferred treatment for this 9300-foot pay zone is 6000 gallons regular Dowell X Acid with agents added to reduce surface tension, reduce silicate swelling and prevent emulsions. Treatment is usually performed down tubing at pressures of 2500-4000 psi.

IN KNOTT COUNTY, KENTUCKY, Stabilized Acid —an exclusive Dowell service—has proved successful in the Big Lime Field, where many wells have actually shown decreased production when treated with other acids. Dowell uses 2000 gallons regular acid, followed by 2000 gallons of acid containing a special stabilizing agent. This relatively low-cost treatment is being accepted as standard in the field.



The *modern* way...

to pump oil wells is the Kobe Hydraulic Oil Well Pumping System . . . costs less to install, maintain and operate.
Simplifies lease planning and minimizes production problems.
Easily transferred.

KOBE HYDRAULIC OIL WELL PUMPING SYSTEM

Free Pump
KOBE
HUNTINGTON PARK, CALIFORNIA

Science or Art?

(Continued from page 195)

and practical research leading to oil finding ability in some individual who came in contact with it. But oil is not found by sheer weight of geologic knowledge or any other knowledge.

Our professional societies are at least in part responsible for impressions made upon the younger geologist members. They honor above all others the men who have accumulated vast knowledge. The man who has acquired knowledge of worldwide geology is apt to receive the highest awards a society may bestow.

The man who is well enough read to have general knowledge of all the oil provinces on any one continent may be given second place in society esteem. A younger man who can recite the complete stratigraphic section in the several basins of the Rocky Mountain region may be considered brilliant.

In other words, our professional societies are prone to honor the accumulation of knowledge. This in itself is good. It does no professional harm unless it draws attention, recognition, or credit from the individual who may be properly familiar with only one small portion of a province but who consistently finds oil in that area.

It is natural for the young geologist to wish to be successful in his chosen science, and to emulate the accepted masters of that field. He will pattern himself after the men who are honored for their knowledge. He will strive to learn as much as he can about as much of the world as he can.

Societies could help . . . Perhaps our professional geological societies could perform a service to themselves, to the membership, and to the industry which supports them, by honoring the men who have successfully applied the knowledge they have. Such a constructive step would very likely harvest more significant recognition to the academic interests in the long run than now results from the homage paid to the accumulation of knowledge per se.

The local and regional geological societies are in the best possible position to appreciate the importance of the constructive application of pertinent knowledge to the finding of additional natural resources. Their publication and recognition policies can do much to regulate the interest and emphasis in professional activity.

It is suggested that in some cases it would be well to inspire proportionately more interest in constructive application of geological knowledge, and emphasize that the results of this interest will carry and justify a secondary interest in maintaining a backlog of accumulated geologic knowledge without specific application.

Perhaps the local society could make a detailed study of how oil is found, by analyzing the steps taken by a successful operator to decide where to explore. The results of such a study should be helpful to the industry in general and to the individual geologist society members in particular.

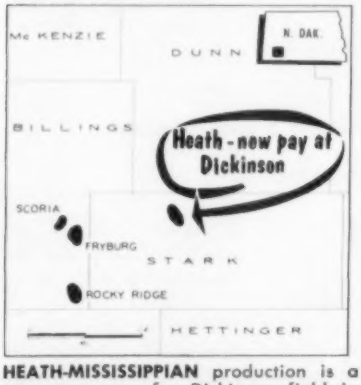
Summary . . . The essential difference between the active oil finder, or artist, and the company geologist, or scientist, is in the application of the knowledge available to both men. The art of the oil-finding artist may be thought of as knowledge made efficient by skill.

A little pertinent knowledge may serve a considerable amount of art. If geologists, as individuals and as groups, would direct their efforts toward learning how best to apply their scientific knowledge, the profession would attain and retain greater respect in the industry. And incidentally, more resources would be found to the credit of our civilization.

North Dakota gets new Heath producer

DICKINSON-MADISON field added a new pay zone last week, the Heath-Mississippian. The discovery well is Atlantic Refining Co. and Goodstein Oil Co. 1 Kadrmas, C NE SE 31-140n-96w, Stark County.

The operators pumped 300 bbl. of oil per day from perforations in the Heath sand at 7,786-7,816 ft. Dickinson field was opened last year in the Madison. The new Heath producer is the southwest offset to the field discovery. The well was supposed to be the discovery confirmation, but was unsuccessful in the Madison.



HEATH-MISSISSIPPIAN production is a new pay zone for Dickinson field in southwestern North Dakota's Stark County.

The 1 Kadrmas, 2 miles northwest of the town of Dickinson, raises hopes for additional development work in southwestern North Dakota this year. In addition to Dickinson field, two other pools were opened in this area last year, both in Billings County to the west. Rocky Ridge-Heath field was one of the biggest strikes in North Dakota since Beaver Lodge.

Follow-up wells were not as promising, however. A failure was reported last week at Northern Pump Co.'s 1 State in S½ SE NE 16-137n-100w. The well was abandoned at total depth of 8,296 ft. It was the west extension try to the field. The 1 State was the offset to 3 Fritz, a successful Heath well for 256 bbl. of oil per day.

Scoria field, northwest of Fryburg field, is a Madison discovery area. The Heath sand has been a pay of promise in North Dakota since it was first tapped successfully at Rocky Ridge. Heath sand belongs to the Big Snowy Group of Mississippian age. Prior to the Rocky Ridge discovery it produced only in Central Montana, and in a few Wyoming pools.

Ohio's Flint Ridge field is growing

Flint Ridge field in Hopewell Township, Muskingum County and Hopewell Township, Licking County, an extensive producing area, was further expanded by 7 Karl Ramey in Section 15, Muskingum County. Scott Oil Co., the operator, reported sand found at 3,278-3,317 ft., which made 15 bbl. natural and 480 bbl. in a 24-hour test after fracture. Eight to ten strings are usually working in the field.

EXPLORATION THIS WEEK

North Dakota	199
Ohio	199
Oklahoma	202
Illinois	204
Canada	206
East Texas	207
South Texas	208
Successful Wildcats	209

Scout check streamlined

Result: Standard scout tickets are printed and ready to go at the end of the meeting

BY CARL HOOT

"THE BIGGEST IMPROVEMENT since we took the scout off the horse," was the comment of one scout department head when asked about the new system of handling scout tickets on well information.

The so-called "new system" is simply a standardized form of oil-well first reports and completion tickets which can be used by all oil companies. In addition to the standard form, the mechanics of stenographic and printing processes are set up by the scouts, and the work is done while the weekly scout check is in progress. Finished, printed tickets are in the scouts' hands at the close of their weekly check meet.

Purpose of the system is to get all companies on a standard ticket, and of equal importance, to get that ticket into the company's hand as quickly as possible.

A survey of oil companies in the Tulsa area showed as many different forms of well tickets as there were companies.

The standard scout ticket described here has passed its tenth week in a 90-day trial run of the Shawnee Oil Scouts, in Shawnee, Okla. Another tryout is under way at Ardmore and one is scheduled soon for Enid. Outlook for the standardized ticket is that it will be accepted and used nation-wide.

Credit for starting the ball rolling on the standard ticket goes to James H. Duck, chief scout for Gulf Oil Corp., Tulsa. When presented to company management, the idea was quickly taken up for further study. Fourteen major oil companies sent representatives from their geological, production, and engineering departments to help iron wrinkles out of the new setup. Chief scouts from Sunray Mid-Continent, Sinclair, Carter, Shell, and many others had a hand in starting the program.

The old way . . . Troubles with the old system of scouts sending in pencilled tickets were many. These included the problem of typing by girls unfamiliar with oil-well language; reading the scout's abbreviations; the many forms and sizes of cards, and the cost of printing duplicates. One official "guessed" his cost at 30 cents per ticket. Another chief scout, who has been in the business 39 years, said he has seen tickets written like a letter, and you had to read them through just to find the well's TD.

Here's a play-by-play rundown

1 Shawnee Oil Scouts' coats are off and the group is ready for exchange of dope by 8 a.m. every Wednesday.

2 Typewriters are wide-carriage, and data are typed "two up" on a multilith form. Two typists and one proofreader turn out from 40 to 75 tickets

F.S. 9-13-57

STANDARD SCOUT TICKET

37

STATE Okla. COUNTY Creek SEC 11 TWP 17N RGE 8E

OPERATOR Kennetn Jones Co. LOC SW SE SW

WELL NO ? FARM NAME Wyatt 330 FT. FROM South LINE

POOL MISQUITO Mc-Ea ELEV 824 DF 1340 FT. FROM West LINE

SPUD DATE 8-13-57 COMP DATE 9-5-57 TYPE DISCOVERY Structure

CONTRACTOR ?

COMPLETION RECORD

I.P. OIL/DIST None WTR HFW SIZE CHKS GR

D&A X1

I.P. GAS MCFPD SIZE CHKS SIPB GOR

TD 2812 PBTD BHPX CPX TPB

MAKE PRODUCING INTERVAL	FROM	TO	PERF W/HOLES	TREATMENT RECORD
Red Fork sand	2556	2564	None	SF MCA

CASING CEMENT RECORD

SIZE	DEPTH	W/SAX	SIZE	DEPTH	W/SAX
12	50		8	1400	
10	900		6⅝	2536	45

SAMPLES DRILLED	DEPTH	ELEC TOPS	DEPTH

Birdwell	
Layton	1198
Checkerboard	1405-10
Big Lime	2050
Owego Lime	2106
Prue	2185
Verdigris	2280
Red Fork	2536-2554

Set 12" @ 50 w/b
Set 10" @ 900
Set 8" @ 1400
TD 2812 Birdwell log 2812 no corres NoDST.

6

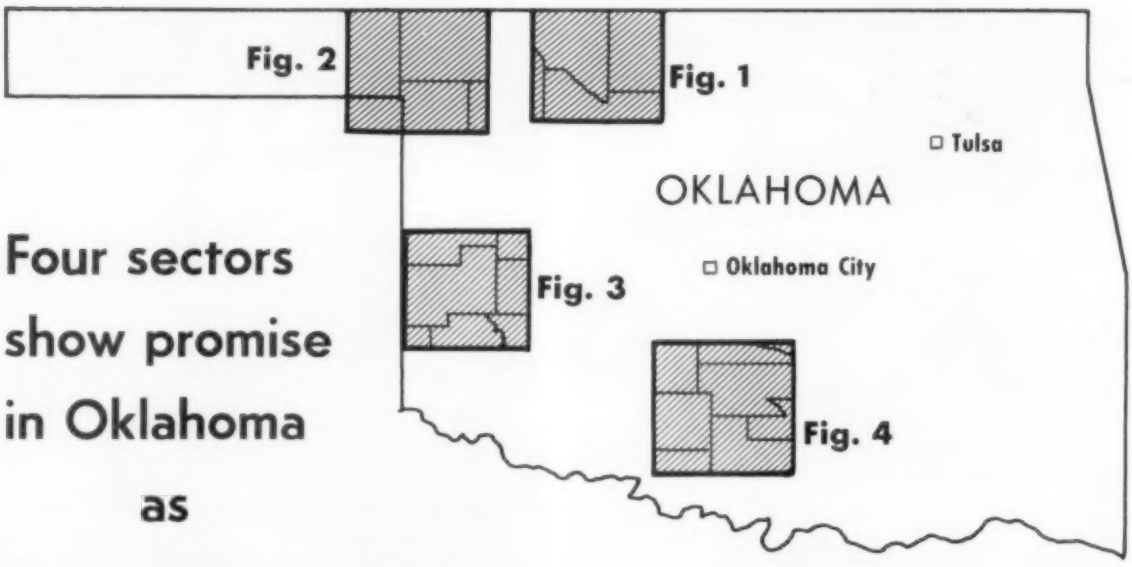
per week. Multilith forms go to the printer when four or five have been finished.

3 Scouts take turns checking to see that finished ticket follows original. Under the old method if the card wasn't clear, you'd wait for the scout to come in, phone him, or write a letter.

4 The multilith printer is the simplest and most economical method of making good printed copies. Tickets are numbered for easy sorting.

5 The smile of satisfaction. Scout John Lohrey, Sinclair, takes seven sets of tickets, which were ready for him before 3 p.m. the same day of the check meet. Costs will vary with each particular check meet, for typists, rent, and other mechanical charges. At Shawnee, with 14 companies participating out of 23, cost has been running from 1 to 5 cents per ticket.

6 The standard scout ticket. This contains well dope from date of first report to completion, with formation tops, shows, etc.



Four sectors show promise in Oklahoma as Wildcatting flourishes

THE FOUR AREAS shown above led the exploration picture in Oklahoma during January, with the northwest predominating.

OKLAHOMA EXPLORATION appears to be on the same success road as in 1957. January discoveries and development programs promise another banner year for the state's success scale. Current centers of wildcat interest are the north, northwest, southwest, and south-central counties.

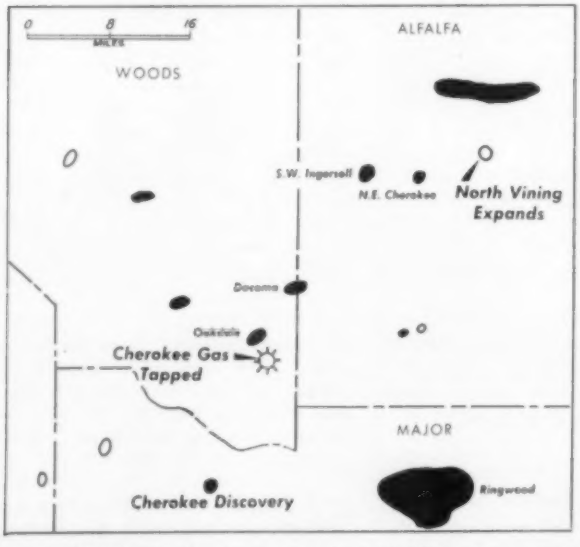
In the north . . . Cherokee-Pennsylvanian discoveries continue to dot the wildcat scene in the northern counties of Oklahoma.

● North Vining field in Alfalfa County expanded as a result of Apache Oil Co.'s success at 1 Clark, NE NE 17-27n-9w. This Cherokee well flowed 10 M.M.c.f. of gas per day with distillate from perforations at 5,164-70 ft. Other Cherokee pools in the area added good producers, continuing a trend that is now over 4 years old.

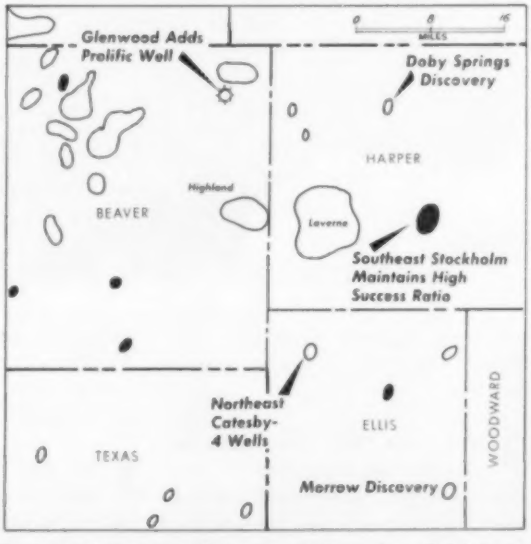
● Major County's contribution to the Cherokee play is Huber 1 Phillips, SW SW 33-22n-14w. This well flowed 70 bbl. of oil per hour from perforations at 6,879-6,912 ft. The discovery set off a spirited lease play in a relatively rank wildcat territory several miles west of Ringwood field.

● An Oakdale area wildcat in Woods County is a new Cherokee producer. Falcon Seaboard found production in the sand at 6,329-55 ft. at its wildcat in SE NE 33-24n-13w. Flow was 2,720 M.c.f. per day. There is considerable Cherokee production in the immediate region . . . Sections 20 and 21 of 24n-13w.

In the northwest . . . Beaver, Harper, and Ellis counties in northwestern Oklahoma all have new pre-Permian areas, new extensions to older areas, and several wildcats with the Pennsylvanian as the target.



1 Cherokee-Pennsylvanian gas and gas-distillate discoveries in northern Oklahoma enhance this section of the state.



2 Pennsylvanian strikes in northwestern Oklahoma's Beaver, Harper and Ellis counties continue at fast clip.

● In Beaver County the most active areas are Glenwood, Forgan, and Boyd fie'ds. Shell Oil Co.'s 1 Lonker-C, SW NE 1-5n-27eCM, south of the main portion of Glenwood field, flowed 28 M.M.c.f. of gas per day plus 6 bbl. of distillate per million.

At the east end of the county the Highland gas district is nearing link-up with huge Laverne gas district.

● The Harper County campaign rolls on unabated. Monsanto Chemical Co. opened a new Morrow-Pennsylvanian gas field at 1 Doby in the Doby Springs area, NE SE NW 1-27n-24w. Open-flow potential of the well was 54 M.M.c.f. of gas per day, calculated. Perforations are at 6,142-47 ft.

J. M. Huber kept interest in Laverne itself high at his 1 Love, NE SW 8-26n-24w. The Hoover well flowed 4,750 M.c.f. of gas per day at 4,218-4,303 ft.; two other zones also produced gas and distillate, the Tonkawa at 5,492-5,508 ft. (flowed 6,250 M.c.f.), and the Morrow at 6,892-6,926 ft. (flowed 3,310 M.c.f. per day).

. . . Stockholm area. The Southeast Stockholm area continues to be one of the most prolific oil areas in northwestern Oklahoma. A January example of this high success ratio is Pure Oil Co.'s well in 29-26n-23w. That Tonkawa - Pennsylvanian well flowed 25 bbl. per hour from perforations at 5,649-56 ft.

● Ellis County is opening up to production with three new fields in recent months. The most successful new producing area developmentwise is Northeast Catesby in the northwest part of the county. Shell Oil Co. completed the new field's fourth gas well for 12 M.M.c.f. of gas per day with 24 bbl. of condensate per day. The 1-30 Tubb, SW NE 30-24n-25w, is a Morrow well at 8,105-36 ft.

Pan American Petroleum Corp. has new production in SE NW 14-21n-23w at the 1 Moore. This well flowed 6,450 M.c.f. of gas per day from lower Morrow at 9,538-70 ft.; from upper Morrow it made 3,700 M.c.f. per day.

Ellis County had had no successful drilling activity since 1952 until last year. The only producing area on the map until 1957 was at South Salon. That field is now off production.

In the southwest . . . North Carter field, one of the exploratory highlights of 1957, was confirmed and a new pay added. Shell 1 Patten, NW SE 9-9n-22w, Beckham County, flowed 397 bbl. of oil per day from a Pennsylvanian zone at 8,705-52 ft.; 3,700 M.c.f. of gas per day from 8,838-79 ft. The pay zone in the discovery well, No. 1 Boyd, was the Springer. That strike moved Springer production to its westernmost point.

In the south . . . An Ordovician discovery on a new fault-trend play in southwestern McClain County, 35 miles south of Oklahoma City, appears to be opening a producing area of major importance.

Gulf Oil Corp. 1 Beard, 18-5n-3w, has an open-flow potential of more than 100 bbl. of oil per hour from first and second Bromide sands, and from the Tulip Creek sand. The well reportedly has 100 ft. of effective pay zone. The Beard well was located on the basis of geophysical interpretations of a complicated pattern of faults which is believed to dissect the area into individual reservoir blocks. From the reserve standpoint, the Beard well is the first major strike of the year for Oklahoma. Production is from zones below 10,000 ft. Some reserve estimates are as high as 50,000 bbl. per acre. Fast development of the new field is expected upon final completion.

. . . Joiner City. The Chimney Hill part of Hunton lime is a new pay for the Joiner City field in Carter County. Frankfort Oil Co. 1 Claxton-Herrington, SE SE SE 28-4s-3w, flowed 300 bbl. of oil per day from this new zone. Regular pay in the field is from the Bois d'Arc part of Hunton. The Chimney Hill discovery indicates further southward extension of the field is in the mill.

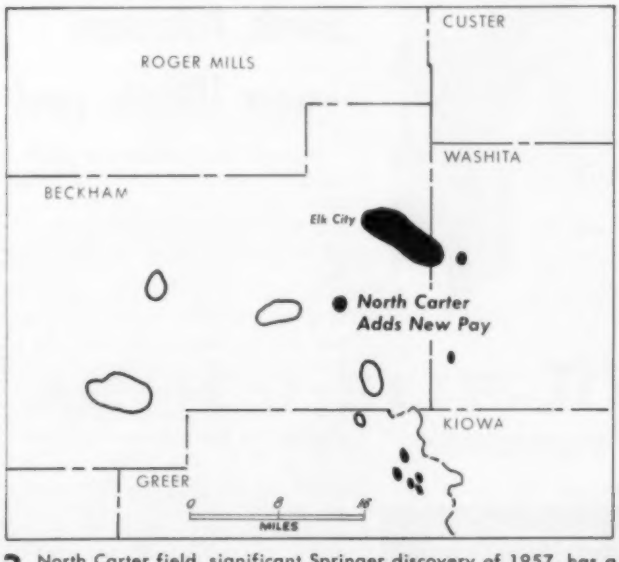
PANHANDLE

Cimarron County Activity Stirs With New Operations

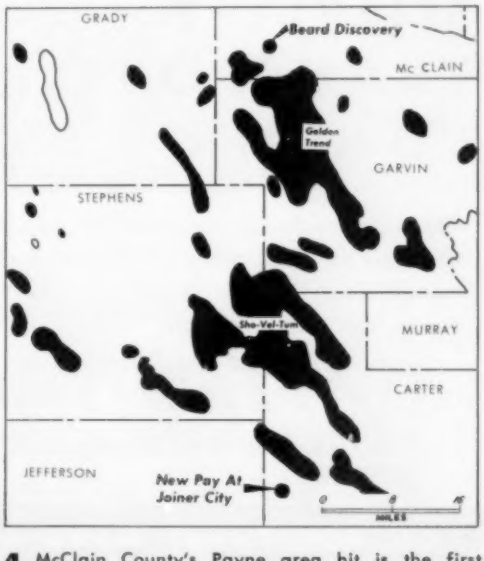
Oklahoma's northwesternmost county, Cimarron, reported a new strike and a significant new location last week. Pure Oil Co. 1 Neff, C SE 1-4n-7eCM, Keyes area, flowed 4,280 M.c.f. of gas per day on initial production test in the Keyes (basal Pennsylvanian) sand at 4,818-40 ft.

In the extreme southeast corner of the county, The Texas Co. will drill 1 Hawkins Unit in C SW NE 26-1n-9eCM, as the first offset to Southeast Griggs pool.

The discovery well in the area was one of last year's Panhandle explora-



3 North Carter field, significant Springer discovery of 1957, has a new pay in Pennsylvanian zones above the Springer.



4 McClain County's Payne area hit is the first major field discovery in Oklahoma this year.

tory highlights. The 1 Youtsler, SW NW SE 23-1n-9eCM, flowed 5,592 M.c.f. of gas per day from the Atoka-Pennsylvanian at 4,284-97 ft.; from the Morrow at 4,576-82 ft. it made 1,448 M.c.f. per day. There were half a dozen possible pay zones in this well, but completion was made only in the Atoka and Morrow. The well went to 5,963 ft. before being plugged back for completion.

Final Tests Made at New Beaver County Strike

A new gas pool was opened in Beaver County at Carter Oil Co. 1 Adams-A, C NE SE 12-6n-24eCM, northeast of Northeast Forgan pool.

The Morrow-Pennsylvanian discovery had an open flow calculated at 1,920 M.c.f. per day from perforations at 5,826-48 ft.

New Inside Hugoton Oil Discovery Finaled

A new Morrow sand oil pool was opened north of North Unity field inside Hugoton gas field in Texas County. The discovery well is Panhandle Eastern Pipe Line Co. 2 Easterwood, C SE SE 11-4n-13eCM.

The Morrow well flowed 342 bbl. of oil per day from perforations at 6,409-13 ft. Another well, the 1 Hanke, C NE SW 11-5n-10eCM, is drilling in this area. The operator is running casing. Still another well in the area, Amerada Petroleum Corp. 1 Fatzer, C SW SW 2-5n-10eCM, north of Panhandle's 1 Reiss Morrow discovery, has been located and will go to the Morrow. The Reiss well was both an oil and gas discovery in the Morrow at 4,456-70 ft.

Gas Condensate Flows at Boyd Pool Well in Beaver

Beaver County's Boyd pool added a good gas-condensate well. Union Oil Co. of California 1 Karber-Pickens, C NW SE 9-2n-21eCM, flowed 30,400 M.c.f. per day on calculated open flow. The well also made 35 bbl. of condensate during a 7½-hour test of Morrow sand. This new well is in the Southeast Boyd area.

SOUTHWEST

Cement Springer Strike Finaled in Caddo County

Pan American Petroleum Corp. has completed a wildcat gas well in Caddo County for 7,350 M.c.f. of gas per day through a ¼-in. choke.

Pan American et al 1 Williams, located in 1-5n-9w, flowed from the Springer through perforations at 14,847-62 ft. on the completion test. The well was drilled to 15,035 ft., plugged back to 14,985 ft., with the Springer topped at 14,386 ft.

South Ashmore —new Illinois pool

One new pool, Ashmore South in Coles County, was discovered in January. An additional oil well and a gas well extension had been completed in this pool by the end of January.

In addition to the gas well extension to Ashmore South pool, there was one extension to each of the following pools: Kincaid South in Christian County, Harco in Saline County, and Storms Consolidated in White County.

A total of 216 wells were completed in January, a 5-week period, for an average of 43 per week. The 216 completions include 92 oil wells and 1 gas well, or 43 per cent successful.

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To go with its recent oil hit, Canadian Shell now has a

Gas strike in Alberta

THE SECOND discovery in 2 weeks has been reported by Shell Oil Co. of Canada, Ltd. Earlier, Shell made its initial strike on Provincial Reserve Lands by recovering crude oil from the Beaverhill Lake structure in the Swan Hills region of west central Alberta.

Now a highly important gas strike has occurred at the firm's Panther River area wildcat in the southwestern sector of the province. Located in the Rocky Mountains, 36 miles north of Banff, Shell entered a reef structure in the Devonian and flowed highly toxic gas at the rate of 7,200 M.c.f. daily during a 12-minute test.

It is not known, however, if the reef was D3 but it appears likely as the last reported sample top taken at the well was the Nisku, or D2 horizon. Little is known as to the thickness of the structure and possibly will remain that way for a short time as the drill-pipe parted in two places when crew members attempted to free the packer upon completion of the drill-stem test. Fishing operations are now under way but the well is in full control.

Devonian gas . . . The most significant factor about the well is gas in the Devonian.

Most wells in the general area, and along the Rocky Mountain front, have not penetrated the structure, but have stopped in the highly prolific Mississippian horizon. The venture, Shell 1 Panther River, on LSD 5, 19-30-10w5, is in fairly virgin territory as there have been only three other tests taken down in a radius of 25 miles of the strike; none of those penetrated the gas-bearing structure. Shell has another well currently under way in this general region and it lies 14 miles north-northeast of the Panther River venture. Drilling operations on it meanwhile, are just under way at the 2,000-ft. level.

Test data . . . Drill-stem test to indicate success at the Panther River strike was run of the interval 9,009 to 9,166 ft. Gas flowed to the surface in 1 minute at a rate measured at 5,700 M.c.f. daily. That rate increased to 6,500 M.c.f. daily in 10 minutes and was still increasing when the valve was shut in 2 minutes later.

The shortness of test was explained by Shell as a safety measure. The gas apparently was very toxic and it took 4 hours for the drill pipe to bleed off. It was following that latter operation that the packer became stuck and fishing operations commenced.

Second strike . . . This is the second major gas strike for Shell near National Park limits. The initial one, at Waterton Park, just 6 miles north of that park's limits, uncovered huge reserves of gas in the Mississippian horizon. That factor, coupled with another major company's successes in the region, has indicated one of the largest Mississippian fields in Alberta.

Only further drilling there and in the vicinity of the new strike will determine the extent of the finds.

Canadian Homestead Oils, Ltd., meanwhile, the only independent in the region, has interests in 139,814 acres of reservation rights starting within 1¼ miles of the strike. Homestead's interests in that acreage is shared by Imperial Oil, Ltd., in 99,840 acres; Union Oil Co. of California has the balance.

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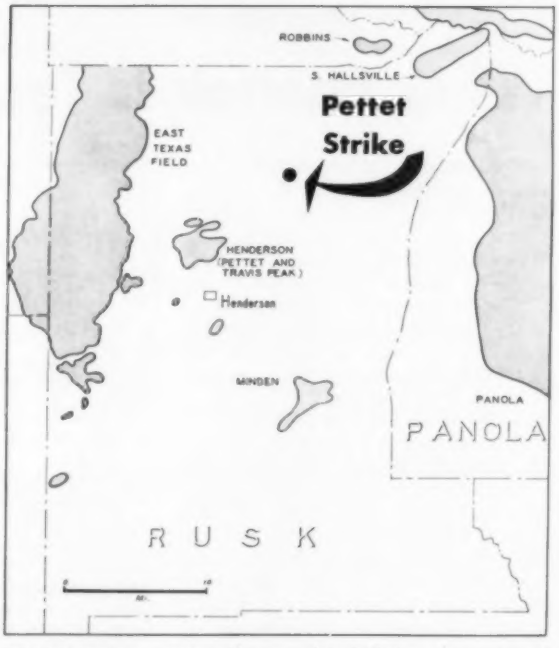
Big Rusk County strike gets offset

Oak Hill opener . . . McKnight 1 Todd opened Oak Hill pool in January with a daily flowing potential of 690 bbl. of 43° oil through ¼-in. chokes. Final perforations were at 7,169½-75½ ft.

While drilling, 1 Todd flowed oil at the estimated rate of 45 bbl. an hour from the Pettet at 7,167-71 ft. Additional tests to 7,180 ft. had flowing oil but only weak gas blows between 7,187-93 ft. Operators drilled ahead to 7,551 ft., entering the Travis Peak at 7,321 ft. on elevation of 382 ft.

British American Oil Producing Co. has staked location for a confirmation attempt to the southeast of Peyton McKnight, Jr., 1 Tood, recent Rusk County Pettet discovery.

The new well is 1 R. T. Hampton, located on a 111-acre tract in the E. C. Young Survey, A-879. Projected depth is 7,600 ft., which is expected to reach the Travis Peak formation, below the Pettet.



TEXAS has a recently completed Pettet discovery in northeastern Rusk County. Last week, British American staked location for a southeast confirmation attempt. Discovery was McKnight 1 Todd.

Smith County extension . . . The Wright Mount area of northeastern Smith County gained a 1½-mile southwest extension, or new pool opener, at Charles W. Lutes and Associates 1 Holt Estate.

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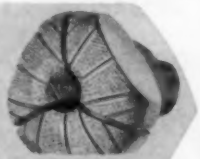

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Gas discovery points way to

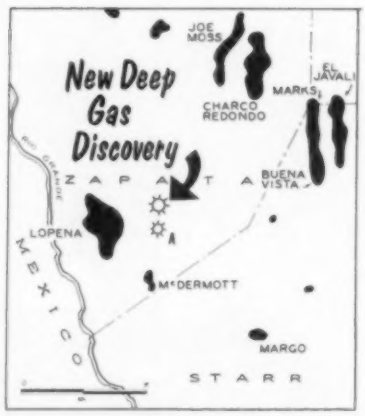
Wilcox reservoir in Texas

ADDITIONAL DEVELOPMENT is due to get under way shortly in the Lopena area, in southern Zapata County, near Texas' Mexican border, following Gulf Resources' new deep discovery east of the field last week.

The discovery well, 1 Ramos Ramirez, is completed in a Wilcox sand at 8,510-80 ft. with a flow rate of 4,450,000 cu. ft. of gas per day through ⅝-in. choke, and flowing pressure of 3,850 psi.

It is more than 1 mile from nearest production in Lopena field, and about 1 mile north of another deep extension well (A on map) drilled by Standard Oil Co. of Texas in 1956. It is the first new development in the area since the latter well (1 Blas Ramirez), shut-in since completion, was drilled.

Gulf Resources' well appears to open a new Wilcox reservoir for the area. The reservoir is regarded not only by this operator but by others in the area as a major reserve. Nearest Wilcox production in the main part of the field is from Wilcox 9,100 and 9,600-ft. zones. Standard of Texas' extension well was complete in a 9,763-78-ft. interval.



GAS PRODUCTION in southern Zapata County is boosted with a new deep discovery well by Gulf Resources.

Log of the new well indicated possible commercial gas production in sands at 6,703-29 ft., 6,995-7,050 ft., 7,455-8,110 ft., 9,115-60 ft., 9,410-35 ft., 9,675-95 ft., and 9,810-30 ft., in addition to the 8,500-ft. zone in which the well was completed. The well was drilled to 12,215 ft.

The operator is planning a development program embracing these sands as well as the 8,500-ft. reservoir.

Acreage on which the discovery is located is a part of a block of approximately 60,000 acres owned by Standard Oil Co. of Texas. It is a "farm-out" from the company. Standard's previously completed extension well is on this block.

CORRECTION

In the recent article, "Careful Groundwork Pays Off in Cooke and Grayson Counties," in The Oil and Gas Journal, February 3, 1958, Exploration Surveys, Inc., Dallas, should have received credit for furnishing the gravity map (Fig. 2) that showed the regional gravity in Cooke and Grayson counties and parts of southern Oklahoma. The gravity map was not a portion of the original article by M. C. Kelsey, but was inserted as part of an over-all summary of a symposium published by the Dallas Geological Society and the Dallas Geophysical Society entitled, "The Geology and Geophysics of Cooke and Grayson Counties, Texas."

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SOUTH LOUISIANA

Calcasieu Parish: Charles H. Lawrence, Jr., 1 Farmers, 19-10s-7w. IP 600 M.c.f. daily, ⅛-in., dry gas, TP 1,650 psi., perfs. 4,586-91 ft. TD 5,106 ft. (New reservoir and extension in West Holmwood area.)

SOUTHEAST NEW MEXICO

Lea County: Cactus Drilling Co. 1-A Gulf-State, 29-19s-35e, 14 mi. W Monument. IP 100 BOPD, 34°, perforations 4,752-4,898 ft. TD 4,998 ft.

Eddy County: H. M. Sweeney 4 Poker Lake Unit, 21-25s-30e, 10 mi. SE Malaga. IP 2,000 M.c.f. gas, open 2-in. tubing, Delaware sand 3,873 ft. TD 3,878 ft.

Tennessee Gas Transmission Co. 1-A John M. Kelly, 34-24s-27e, 15 mi. S Carlsbad. IP 2,240 M.c.f. gas, calculated open-flow, Permo-Pennsylvanian pay 10,870 ft. TD 10,917 ft.

Union Oil Co. of California 1-26 Crawford, 26-24s-26e, 7 mi. NE White City. IP 6,200 M.c.f. gas, calculated open-flow, perforations 11,060-11,451 ft. TD 11,522 ft. Formation tops: Bone Spring 5,340 ft., Cisco 9,860 ft., Canyon 10,060 ft., Strawn 10,310 ft., Morrow 10,906 ft., elev. 3,261 ft.

MISSISSIPPI

Adams County: Hellenic Oil & Gas Co. 12-C Overton Hills, 22-5n-3w. IP 134 BOPD, ⅛-in., 41°, TP 345 psi., perfs. 6,445-48 ft. (Wilcox). TD 11,807 ft. Elev. 199 ft., Wilcox 4,592 ft., base Big shale 5,742 ft., lower Tuscaloosa 10,894 ft., Lower Cretaceous 11,050 ft. (New pay and extension in Overton field.)

Magnolia Petroleum Co. 2 Armstrong, 9-6n-4w. IP 105 BOPD, ¼-in., 44.5°, GOR 350 cu. ft. per barrel, TP 190 psi., perfs. 7,114-28 ft. (Wilcox-McKittrick sand). TD 7,282 ft. Elev. 63 ft., Wilcox 4,948 ft., base Baker shale 7,096 ft. (Extends Louisiana's North Esperance field into Mississippi—bottom-hole location under Mississippi River.)

ALBERTA

Pan American A-1 Birch Lake, LSD 11, 11-51-12w4. Basal quartz gas well. TD 2,650 ft.

TEXAS GULF COAST

Jefferson County: Cyprus Oil Co. 2 Lahmann-Howth, T&NO Sur. 71. IP 4,000 M.c.f. daily and 120 BCPD, ⅛-in., perfs. 10,003-08 ft. (third Nodosaria sand). TD 10,257 ft. (New pay in Baurer Ranch field.)

Live Oak County: Coastal Trend Oil & Gas Corp. and Signet Drilling Co. 2 Freeman, Sec. 207, SK&K Sur., A-445 (4 miles west of Dinero). IP 124.20 BOPD, 9/64-in., 31.6°, GOR 580 cu. ft. per barrel, TP 600 psi., perfs. 3,807-3,900 ft. (Upper Hockley), and 121.50 BOPD, 7/32-in., 36°, GOR 510 cu. ft. per barrel, CP 400 psi., perfs. 3,919-22 ft. (Lower Hockley). TD 4,610 ft. (New field—Buckeye Knoll.)

Humble Oil & Refining Co. 5 McCaslin, J. H. Dennis Sur., A-162. IP 8.12 BOPD (net), 85 per cent water, 3/8-in., 41.2°, GOR 2,739 cu. ft. per barrel, perfs. 5,773-84 ft. (Yegua). TD 5,907 ft. (New pay in Southwest Ramirena field.)

Kleberg County: Katz Oil Co. et al 1 Woefel, Lot 2, Sec. 35, Kleberg Town & Improvement Subd. (3½ miles northeast of Ricardo). IP 112 BOPD (net), 30 per cent water, 9/64-in., 35.2°, GOR 590 cu. ft. per barrel, TP 390 psi., perfs. 7,207-21 ft. (Frio). TD 8,041 ft. (New field 2 miles north of Ricardo field—North Ricardo.)

Matagorda County: Pan American Petroleum Co. 1 Bay City Unit 11, Bay City Town Tract 171, I&GN Sur., A-269. IP 178.5 BOPD, ⅛-in., 39.1°, GOR 829 cu. ft. per barrel, TP 1,000 psi., perfs. 7,911-14 ft. (Frio-Parker sand). TD 8,900 ft. (New pay in East Bay City field.)

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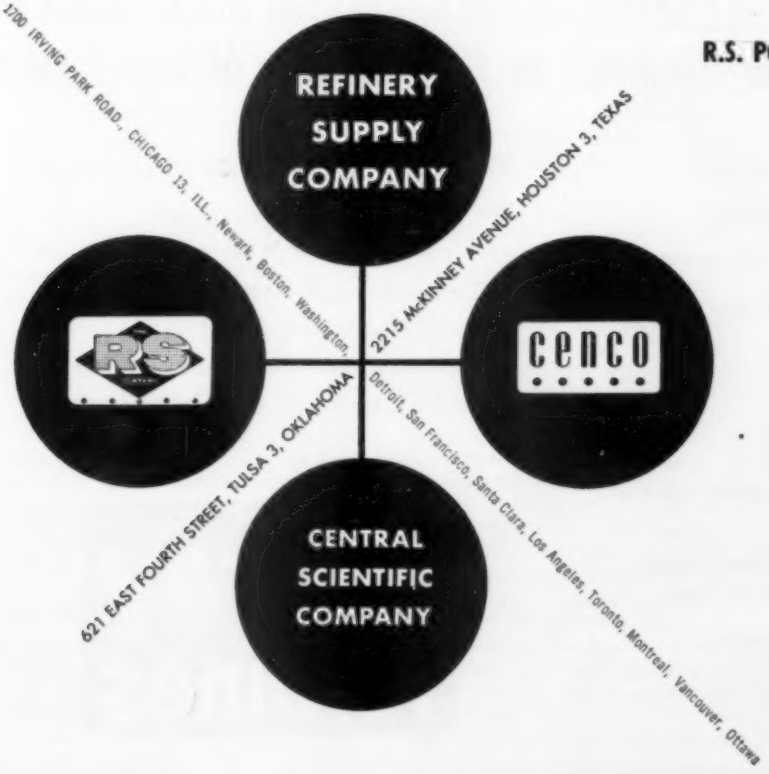
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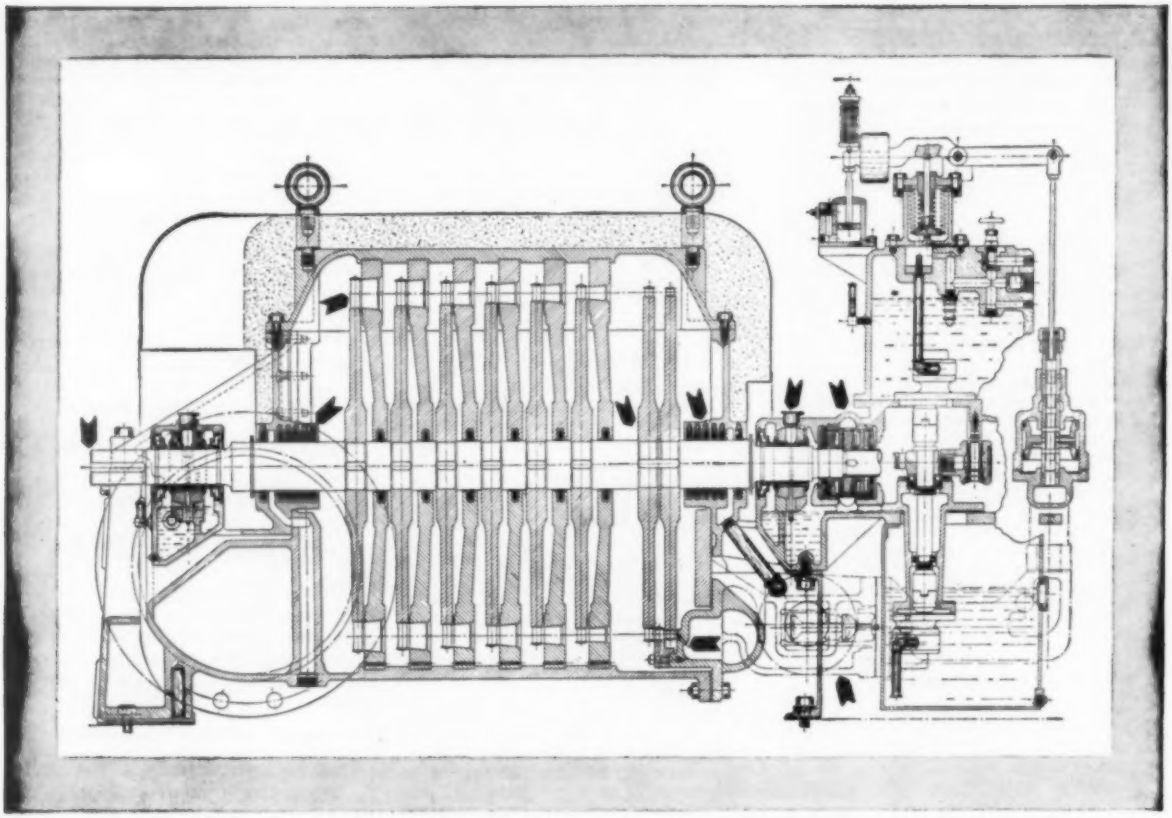
- **Gas pressures on pipe line leakage tests**

This instrument is based on the principle of generation of pressure by application of a known weight to a hydraulic piston on known area. Conversely, an unknown pressure can be measured by balancing its force on a piston of known area with a known weight—the result is extremely accurate pressure readings.



ANOTHER INSIDE STORY OF THE UNIVERSAL ACCEPTANCE OF MURRAY MULTI-STAGE TURBINES IN THE MECHANICAL DRIVE FIELD

- Husky accurately machined shaft.
- Discs shrunk and keyed in place.
- Stainless steel nozzles and blading throughout.
- Spherical seated sleeve bearings.
- Kingsbury thrust bearing.
- Center line support.
- Carbon ring gland seals.
- Double seated balanced governor valve — stellited.
- Choice of speed governors from simple mechanical type to precision oil relay.
- Bolt type overspeed trip governor.
- Steam conditions to 600 PSIG and 750°F.
- Condensing or non-condensing.

Our nearest representative will gladly help you solve your mechanical drive turbine requirements. Just write to Murray Iron Works Company, Burlington, Iowa, for his name.

★ ★ **Murray Turbines** ★ ★

HARRY G. FAIR

Phillips Taps a Young Man

. . . for big things. Harry Fair is just 41 years old, but he's climbed the Phillips ladder like a man who's going places.

TWO MOUNTED fish grace the office entrance of Phillips Petroleum Co.'s Kansas City refinery. Beneath them is a plaque which reads:

"These uninvited guests visited this refinery Friday, July 13, 1951."

On the date this visit occurred, 35-year-old Harry G. Fair had been holding down his first big executive job for Phillips for just 2 months. He had no sooner warmed the seat as manager of the refinery when the floods came.

The Kaw River backed up the waters of the Missouri, and Harry Fair found himself rowing a boat to work. His refinery was 90 per cent under water, some of it 20 ft. deep.

The way young Fair pulled the refinery through this major disaster and went on to complete a massive expansion program at the plant marked him for bigger jobs down the road in the Phillips organization.

Two years later he returned to the home office at Bartlesville, Okla., to become assistant chairman of the company's operating committee, and in 1956 he was elevated to chairman.

At Phillips folks figure that men who head the operating committee are on their way up. President Paul Endacott was the first operating committee chairman, and Executive Committee Chairman Stanley Learned was the second.

Already Harry Fair has advanced a notch. In November, at the age of 41, he became manager of the Supply and Transportation Department and president of Phillips Pipe Line Co., a subsidiary.

The early years . . . Fair is an Oklahoma product. Born at Okmulgee, site of a Phillips refinery, he grew up in the oil business. His father was a drilling contractor, and young Harry worked summers in the oil fields and in refineries while attending Okmulgee Junior College and the University of Oklahoma.

With his chemical engineering degree from Oklahoma he went to work for Phillips in 1939 at the Kansas City refinery. Four years later he had his first stint at Bartlesville as assistant to the vice president of the refining department, where he concentrated on economic evaluation and worked closely with the U. S. Government on construction of aviation gasoline plants and sale of avgas for war use. He spent considerable time in Washington.

The war over, he returned to Kansas City as assistant manager of the refinery and was promoted in 1951 to manager. During his 6 years as a refinery executive he helped construct half a dozen new units and plants. Fair is particularly proud of the complete lubricating plant, built from scratch. It combined the five latest processing steps to make it the most modern in the world at the time.

When Fair went back to Bartlesville for duties on the operating committee, he caught the eye of the top brass with his grasp of big money matters. Under Fair, the committee established comprehensive budgetary control of capital expenditures. The system gave every department a dollars-and-cents understanding of where it stood at all times.

The present . . . In his new job as chief of supply and transportation, Fair runs one of the biggest of Phillips' departments. He handles all crude and products pipelines and all traffic business such as tanker, railroad, and truck movements.

His job covers purchasing and supply of products and coordinating supply with production. He buys products from other manufacturers when the Phillips supply is short. And he buys, sells, and trades crude oil.

Fair's experience, past and present, cuts a wide path across Phillips' big integrated operation.

Despite his heavy load at the office, Fair is an all-round citizen and family man. He was president-elect of the Kansas City Chamber of Commerce when he was transferred back to Bartlesville. He's a Y.M.C.A. board member, Episcopal Church vestryman, and has been a district Boy Scout chairman.

He and Mrs. Fair have three boys and a girl, 5 to 15 years of age, and he's a woodworking hobbyist.

Harry Fair loves the oil business because "the problems, the complexity, and the diversity make it a challenge."

"Changes are rapid in all phases of the industry," he says. "It keeps you on your toes. And it gives you the opportunity to apply your ingenuity and resourcefulness."

J. P. Moran has been transferred by Dowell Incorporated from Houston, where he was district engineer, to Tulsa as reservoir engineer in the company's chemical research laboratory. **J. A. Harmon,** district engineer in Wichita Falls, Tex., has transferred to New Orleans in the same capacity. Harmon succeeds **E. A. Ernst,** now district engineer in Wichita Falls.

Personals

Permian Basin Geophysical Society Elects

Five Midland, Tex., geophysicists will direct operations this year for the Permian Basin Geophysical Society. They are, left to right, S. L. Hake, National Geophysical Co., secretary; R. A. Baile, Empire Geophysical Co., first vice president; B. B. Owings, Forest Oil Corp., president; John M. Armstrong, Cities Service Oil Co., treasurer; and John E. Clark, Union Oil Co. of California, second vice president.

Dr. C. R. McEwen has been promoted to section leader at Union Oil Co.'s Brea, Calif., research center.

L. O. Thompson, formerly division geologist for Felmont Oil Co., Midland, Tex., for the area west of the Mississippi in the U. S. and taking in western Canada, has been named chief geologist for American Maracaibo Co. and Felmont Oil, American Maracaibo's domestic operating subsidiary.

S. A. SWENSRUD

Sidney A. Swensrud, retired chairman of Gulf Oil Corp. and former executive vice president of Standard Oil Co. (Ohio), **Richard C. Sauer,** Sohio vice president of supply and distribution, and **T. Keith Glennan,** president of Case Institute of Technology, have been nominated for directors of Standard of Ohio. Their election at the company's annual meeting April 28 would increase the board to 12 members.

G. W. Oliver has been appointed chief evaluations geologist in the Houston production department of Standard Oil Co. of Texas. **V. E. Tims** has been named Eastern division development geologist, also in the Houston production department. In other appointments, **E. C. Masdon, Jr.,** has been named assistant to the chief development geologist, Houston, and **Clarence Lohman, Jr.,** becomes offshore district geologist, Houston exploration department.

Joseph S. Clark, Jr., formerly a vice president of DeGolyer & MacNaughton, Inc., has joined the oil and gas department of White, Weld & Co.

J. N. Pederson has been appointed senior drilling engineer in New Orleans for The California Co. He was formerly on special production assignment in San Francisco.

E. H. Tollefson, vice president in charge of planning and gas supply and a director of Consolidated Natural Gas Co., has been elected executive vice president.

E. W. Kilgren, chief plant engineer for Pan American Petroleum Corp.'s production department, has been appointed vice chairman of the technical committee of Natural Gas Association of America.

L. G. Christie, senior geologist in Shell Oil Co.'s head office exploration department, has been named manager—Canadian liaison in the department. **H. M. Fritts,** also senior geologist in the head office exploration department, has been appointed manager—U. S. operating, head office exploration department. Shell has also named **R. E. Van Ingen** manager of the distilling department at the Wilmington, Calif., refinery. He was formerly at the Anacortes, Wash., refinery. Van Ingen succeeds **F. E. Esterlin,** who has retired. **T. F. Leeds,** assistant manager of the lubricating-oils department at the Wood River, Ill., refinery, has moved up to department manager. He replaces **C. W. Ryan,** who has retired.

L. E. Kanne has resigned as division manager at Midland, Tex., for Bankline Oil Co. to become an independent operator at Midland.

J. B. Bozeman, formerly geologist with Carter Oil Co. in Billings, Mont., has joined Canadian Seaboard Oil Co. in Calgary.

George B. Dowell, Sun Oil Co., has been elected 1958 chairman of the Spindletop section of Society of Petroleum Engineers of AIME. Other officers are **G. P. Cokinos,** Texas Railroad Commission, vice chairman; **Carl B. Rush,** Pan American Petroleum Corp., secretary; and **E. J. Noone,** Gulf Oil Corp. treasurer.

W. A. WILLIAMS

William A. Williams has been named refining coordinator for Standard - Vacuum Oil Co.. He succeeds **Alfred B. Vought,** who has retired. Vought had been refining coordinator since 1954. Williams was superintendent of the Montreal refinery of Imperial Oil, Ltd., before joining Standard Vacuum in 1952. He served 3 years as chairman and managing director of Stanvac's refining subsidiary in India during construction and initial operations of the company's Bombay refinery.

Charles Doebble, formerly drilling and service contractor, has joined Venezuelan Atlantic Refining Co., as chief petroleum engineer at Lake Maracaibo. His main duty will be to observe operation of a concession on the lake in which Venezuelan Atlantic has part interest.

T. K. Davis, J. L. Parrish, and **B. J. Whitley** have been named general superintendents in Tennessee Gas Transmission Co.'s gas transmission department. Davis will be in charge of compressor, measurement, and gas control sections. Parrish will supervise pipeline construction, research, corrosion control, and radio operations. Whitley will be responsible for operation and maintenance of pipeline facilities. He will continue as manager of the transmission rights-of-way section. In other appointments, TGT has named **Ross O. Parker, Jr.,** and **George W. White** assistant chief engineers.

Personals

Walter J. Nolan, general superintendent of Sheehan Pipe Line Construction Co., Tulsa, has been named vice president of Oklahoma Pipe Line Constructors, Dallas. Nolan has engaged in pipeline construction for 24 years. About half this time he was with Sheehan. He also has been a superintendent for Fish Constructors, Inc., Williams Brothers Co., R. H. Fulton & Co., and O. R. Burden Construction Corp.

Dr. Walter C. Bradbury has joined Cities Service Research & Development Co.'s product development laboratory at Cranbury, N. J., as a section head in the analytical division. He has formerly been with Celanese Corp., Dow Chemical Co., and Upjohn Co.

Roy C. Williamson, assistant manager of Sinclair Oil & Gas Co.'s Fort Worth division, has moved up to division manager. Sinclair has also named **Roy E. Dosser,** executive assistant in Jackson, Miss., manager of the Jackson division. Williamson succeeds **P. C. Brooke,** vice president and division manager in Fort Worth. Brooke has taken a leave of absence and will retire this year. Dosser succeeds **J. F. Snyder,** vice president and division manager, who also is retiring. **Gene O. Davis,** Jackson division geologist, has been named assistant division manager in Jackson. In Fort Worth, **M. H. Lowrance,** exploration superintendent of the division, will succeed Williamson as assistant division manager. **D. A. Jerome,** staff landman in the Houston division, will replace Lowrance as Fort Worth exploration superintendent.

R. E. DOSSER

R. WILLIAMSON

James D. Bushnell has been named head of the fuels and treating section of Esso Research & Engineering Co.'s planning engineering division. **Daniel Hartley** has been appointed head of the mechanical engineering development section, design engineering division.

Robert H. Dunn has been promoted by Lone Star Producing Co. from geologist in Oklahoma City to district geologist in Midland, Tex.

P. Craig Livesay, manager of the Neodesha, Kans., refinery of Standard Oil Co. (Ind.), will become manager of the Sugar Creek, Mo., refinery March 12. He succeeds **Harold R. Boehmer,** who has retired. **Harry G. Schnetzler,** assistant refinery manager at Neodesha, will succeed Livesay.

H. V. Aiguier, tool pusher, has been transferred to Andrews, Tex., from Seminole, Tex., by Helmerich & Payne, Inc.

H. George Shimp, formerly assistant process engineer, has been appointed a process engineer in Sun Oil Co.'s manufacturing engineering division.

DEATHS

Frank Haskell, 90, who was honored as the oil "pioneer of pioneers" at the 1948 International Petroleum Exposition, died February 10 at his home in Sharon, Conn. Haskell's industry career spanned 70 years. He was a retired director and one of the founders of Tidewater Oil Co. Haskell was the first president of the Mid-Continent Oil and Gas Association, organized in 1917, and was a charter board member of American Petroleum Institute. He was a past president and life member of API's Kansas-Oklahoma division.

Donald Daniel Dempster, Seguin, Tex., manager of field operations for Dempster Oil Co., was killed in an oil-field explosion February 4. He was 34.

Loren H. Rogers, 48, Charleston, W. Va., one of the owners of Rogers & Wright, Inc., died February 8 in Charleston. Rogers founded the supply firm with **Harold A. Wright** in 1938. They were also oil producers.

Dr. Vladimir A. Kalichevsky, 62, Magnolia Petroleum Co. consulting engineer and widely known author, died February 4 in Beaumont. Kalichevsky, a native of Russia, came to the U. S. in 1921. Although barely able to speak English, he received a chemical-engineering degree from California Institute of Technology 3 years later. He worked for Union Oil, Esso Research & Engineering, and Socony Mobil before joining Magnolia in 1944. He was winner of the American Chemical Society's Southwest Award in 1955.

Clarence G. Armstrong, 70, president of Armstrong Petroleum Co., San Antonio, Tex., died February 6 in Bandera, Tex. Armstrong founded the old Standard Lubricants Co. in Tulsa in 1920. He organized Armstrong Petroleum in 1936.

John G. Catlett, 72, Tulsa independent producer, died February 8 in Tulsa after a heart attack. Catlett was owner of J. G. Catlett Co., Tulsa. He had been in the oil business since 1913.

William Palmer Lawrence, 47, geophysical party chief for Amerada Petroleum Corp., died February 6 in Fort Pierce, Fla. His brother, **K. M. Lawrence** of Tulsa, is chief geophysicist for Amerada.

Gilbert F. McNair, 55, independent operator of LaPorte, Tex., died recently after a heart attack. McNair was with Shell Oil Co., Pan American Petroleum Corp., and Ashland Oil & Refining during his 30-year career. He left Ashland in 1954 to become an independent in Houston.

Philip Maverick, Jr., 42, reservoir engineer for Carlton Beal & Associates, Midland, Tex., was officially listed as a drowning victim last week. He had been missing and presumed dead since November 29 when his sailboat capsized on North Concho Lake near San Angelo, Tex. A body identified as that of Maverick washed ashore February 1.

John Paul Jones, 55, former general manager of International Petroleum Co., Ltd., died February 10 in New York. He had spent 25 years in South America with Creole Petroleum Corp., Tropical Oil Co., and International Petroleum before retiring 8 years ago.

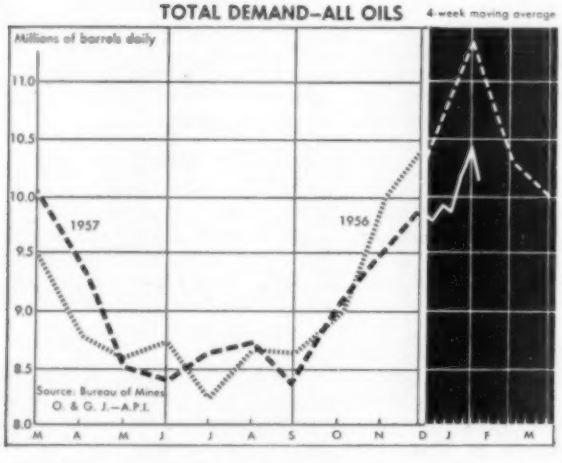
M. J. McKinney, 56, Houston, vice president of Eastern States Petroleum & Chemical Corp., died February 7 at Enid, Okla., after a heart attack.

Edwin S. Quinn, 60, head of Shell Oil Co.'s natural-gas department, died February 8 in New Orleans after a heart attack.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,881,000	UP	46,125	DOWN	745,637
Crude stocks	281,221,000	UP	4,339,000	UP	27,230,000
Completions	889	DOWN	111	DOWN	261
Refinery runs	7,325,000	DOWN	223,000	DOWN	794,000
Gasoline stocks	208,043,000	UP	3,484,000	UP	8,148,000
Kerosine stocks	21,580,000	DOWN	1,599,000	DOWN	2,034,000
Distillate stocks	117,552,000	DOWN	5,569,000	UP	24,036,000
Residual stocks	57,627,000	UP	125,000	UP	20,585,000
Four-product stocks	404,802,000	DOWN	3,559,000	UP	50,735,000
Total imports	1,238,500	DOWN	540,400	DOWN	273,800



Cold weather came at wrong part of season to help distillate prices

COLD WEATHER has boosted sales of distillate fuels but has had very little influence on prices. Group 3 refiners report good movement of No. 2 fuel out of pipeline terminals all along the Great Lakes Pipe Line, but any unbranded jobber can buy all he needs at 8.50 cents a gallon plus transportation from the Group 3 area.

On the Gulf Coast, refiners are still maintaining formal quotations of 8.5 cents a gallon for No. 2 fuel in cargo lots. However, this material is readily available at 8.25 cents and could be bought for 8.00 cents if the buyer had a tanker ready to load.

Discounts are still available off the new low postings on the East Coast. Formal quotation for barge delivery of No. 2 fuel in New York Harbor is 9.85 cents a gallon, but some of the large suppliers are meeting competition on discounts of 0.20 cent off normal postings. Discounts on the East Coast reflect the low prices at which material is available on the Gulf Coast.

The fact that No. 2 is moving at 9.65 cents for barge delivery in New York Harbor means the seller is not basing his price on formal postings of 8.5 cents on the Gulf Coast. Clean spot tanker rates have been averaging about 7.5 per cent below the Maritime Commission base rate. This amounts to 0.83 cent per gallon for tanker movement of No. 2 fuel from the Gulf Coast to New York Harbor. The difference between 9.65 cents and 9.33 cents is not enough to cover unloading costs, insurance, terminal charges, and barge costs in New York Harbor.

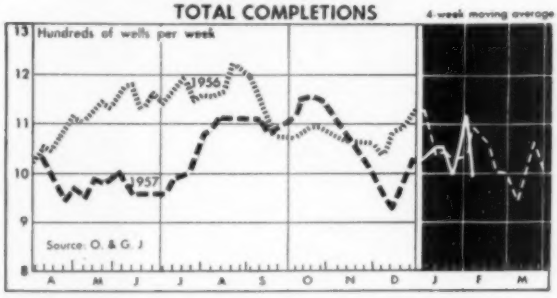
Some of the marketers on the East Coast are estimating that the period of low temperatures will cover a period of 10 days to 2 weeks. But, it comes at the wrong end of the season to help heating-oil prices. The same amount of cold weather near the start of the heating season could have added $100,000,000 to refinery income in areas east of California. Cold weather and increased movement early in the season could have prevented some of this winter's price cuts. Also, refiners could have gone a long way toward preventing the cuts by tailoring supply to demand.

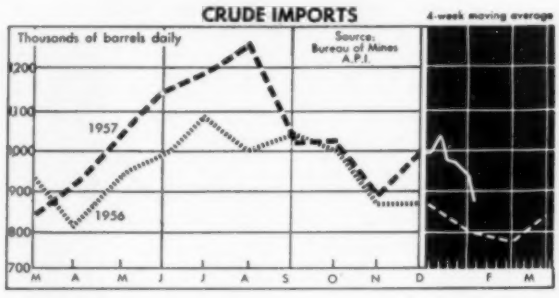
Here's what has happened to No. 2 fuel over the past year. The Group 3 price went to 9.50 cents a gallon after the crude-price increase in January 1957. It now is off to 8.50 cents.

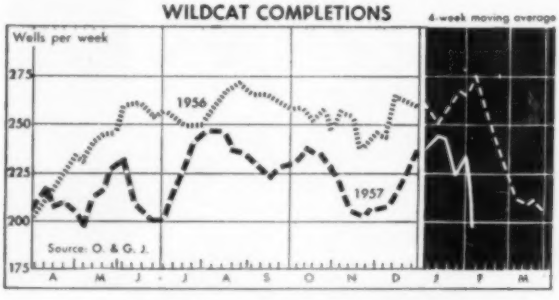
The barge price in New York Harbor was 11.65 cents after the crude-price increase. The latest reported discounts leave a net of 9.65 cents.

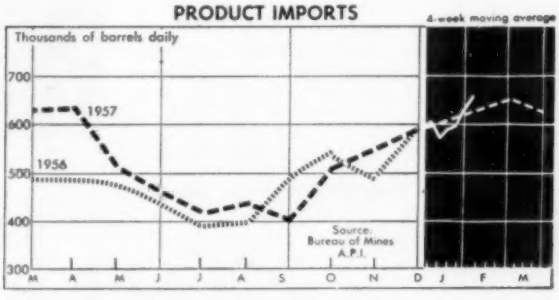
The cargo price on the Gulf Coast was 10.25 cents in January 1957. No. 2 fuel is available at 8.00 cents this week.

Domestic demand for distillate fuels east of California will total about 265,000,000 bbl. for the 4-month period from November through February. An extra cent a gallon or 42 cents a barrel would have added $111,000,000.







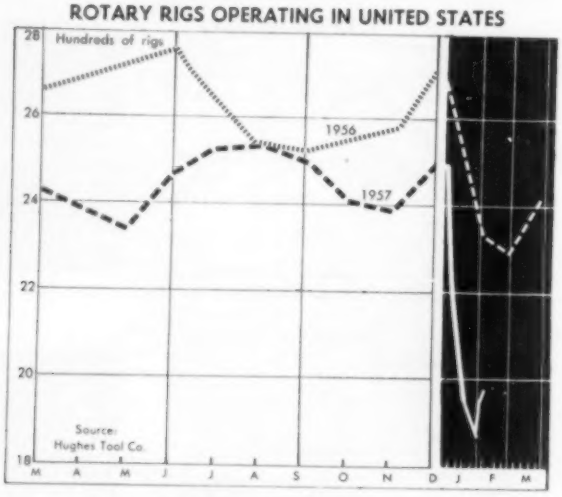


WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 8, 1958

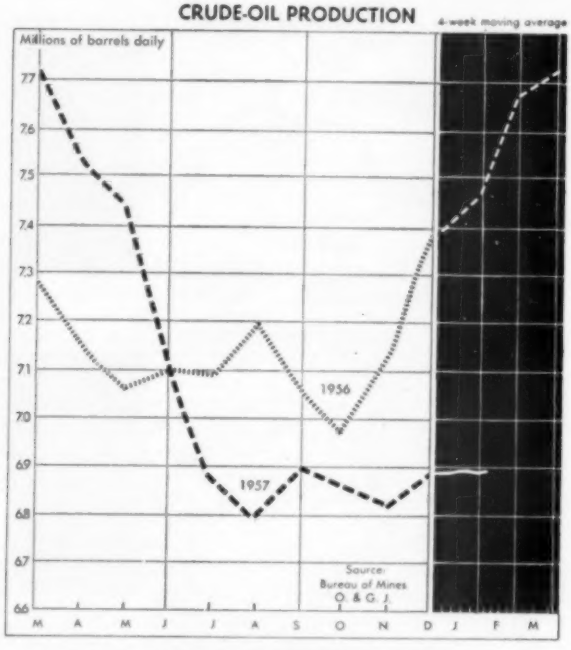
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	0	0	0	0	0	0	0	8	4	0	0	0	0	0	4	3
Arkansas	12	8	0	1	3	0	42,376	88	144	2	0	0	1	1	17	20
California	36	26	0	0	10	0	160,879	236	251	7	0	0	0	7	40	67
Colorado	15	5	0	2	8	0	73,738	71	146	12	2	0	2	8	40	100
Illinois	32	16	0	0	16	0	78,086	228	292	5	0	0	0	5	48	73
Indiana	9	4	0	0	5	0	15,356	79	82	2	0	0	0	2	28	12
Kansas	74	35	0	0	36	3	274,481	442	478	19	1	0	0	18	103	92
Kentucky	12	5	0	3	4	0	14,781	115	186	3	1	0	0	2	15	39
Louisiana	51	25	5	1	20	0	410,521	390	440	3	0	0	0	3	49	82
North	17	8	0	0	9	0	76,381	135	190	1	0	0	0	1	23	22
South	26	10	5	1	10	0	270,334	203	188	2	0	0	0	2	23	52
Offshore	8	7	0	0	1	0	63,806	52	62	0	0	0	0	0	3	8
Michigan	8	3	0	0	5	0	22,730	38	42	4	0	0	0	4	14	18
Mississippi	6	2	1	0	3	0	52,017	55	29	5	2	0	0	3	31	13
Montana	10	6	0	0	4	0	64,334	55	43	7	3	0	0	4	31	16
Nebraska	13	4	0	0	9	0	79,028	77	91	7	1	0	0	6	38	54
New Mexico	51	23	3	15	10	0	236,231	288	237	12	2	1	0	9	48	38
West	26	4	0	15	7	0	110,659	144	89	6	0	0	0	6	23	14
East	25	19	3	0	3	0	125,572	144	149	6	2	1	0	3	25	24
New York	10	5	0	0	0	5	13,500	65	.....	0	0	0	0	0	5	.....
North Dakota	7	6	0	0	1	0	37,320	46	32	1	0	0	0	1	16	11
Ohio	13	5	0	3	3	2	35,041	93	108	0	0	0	0	0	3	2
Oklahoma	140	82	4	5	41	8	496,701	874	828	21	4	0	2	15	133	99
Pennsylvania	0	0	0	0	0	0	0	0	*39	0	0	0	0	0	0	*13
Texas	330	185	7	23	111	4	1,364,184	2,225	2,648	57	5	0	2	50	477	787
District 1	12	0	0	2	10	0	41,227	108	138	7	0	0	0	7	42	57
District 2	11	2	1	4	4	0	56,521	75	78	0	0	0	0	0	19	41
District 3	23	8	3	0	12	0	169,997	157	217	6	0	0	0	6	29	74
District 4	34	16	1	2	15	0	118,902	152	175	5	0	0	0	5	48	74
East	25	21	0	0	4	0	105,751	163	165	2	0	0	0	2	49	49
District 7-B	34	15	0	1	18	0	112,523	259	378	15	3	0	0	12	88	154
West	94	74	0	1	19	0	455,752	664	702	11	1	0	0	10	107	126
District 9	71	36	0	5	26	4	203,674	492	608	9	0	0	2	7	80	191
District 10	26	13	2	8	3	0	99,837	155	187	2	1	0	0	1	15	21
Utah	7	7	0	0	0	0	39,349	48	18	0	0	0	0	0	9	11
West Virginia	31	4	0	22	5	0	80,148	85	87	1	0	0	0	1	1	7
Wyoming	19	12	0	1	6	0	101,775	91	104	4	0	0	0	4	38	38
Miscellaneous (Ariz.)	3	0	0	0	3	0	5,161	17	12	3	0	0	0	3	13	6
Total U. S.	889	468	20	76	303	22	3,697,737	5,714	6,341	175	21	1	7	146	1,201	1,601
Total prev. week	1,000	510	16	90	360	24	4,057,636	.....	.....	173	20	3	5	145	.....	.....
Cum. 1958	5,714	2,828	133	427	2,208	118	23,972,260	.....	.....	1,201	105	13	53	1,030	.....	.....
Western Canada	59	37	0	7	15	0	319,588	262	184	18	5	0	1	12	79	58

*Incl. New York.

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL PRODUCTION



ACTIVE ROTARY RIGS*

	2-10-58	2-3-58	1-27-58	2-11-57
Alabama	10	11	9	6
Arkansas	16	16	15	14
Arizona	1	1	1	....
California	87	87	89	104
Colorado	36	35	33	36
Florida	1	1	1	2
Georgia	....	....	....	....
Idaho	....	....	....	....
Illinois	37	27	24	24
Indiana	4	....	1	....
Iowa	3	3	3	1
Kansas	124	119	104	150
Kentucky	2	....	1	3
Louisiana	326	337	333	451
North	29	31	31	49
South	231	234	231	298
Offshore	66	71	71	104
Maryland	....	....	....	1
Michigan	9	6	7	12
Mississippi	47	42	41	7
Missouri	....	....	....	....
Montana	26	28	27	23
Nebraska	17	15	18	30
Nevada	....	....	....	1
New Mexico	114	109	107	122
New York	1	1	1	....
North Dakota	33	33	40	21
Ohio	2	3	3	....
Oklahoma	205	197	168	209
Oregon	....	....	....	....
Pennsylvania	11	10	10	10
South Carolina	....	....	....	1
South Dakota	....	1	1	2
Texas	773	763	720	928
Gulf Coast	164	158	144	205
Offshore	4	4	5	7
West	314	316	303	370
North	250	247	232	292
East	41	38	36	54
Tennessee	....	....	....	....
Utah	40	45	47	32
Washington	....	....	....	1
West Virginia	4	4	4	2
Wyoming	53	53	53	46
Virginia	....	....	....	....
Total United States	1,982	1,947	1,861	2,250
Western Canada	214	226	221	224
Eastern Canada	....	1	1	....
Grand total	2,196	2,174	2,083	2,494

*Hughes Tool Co.

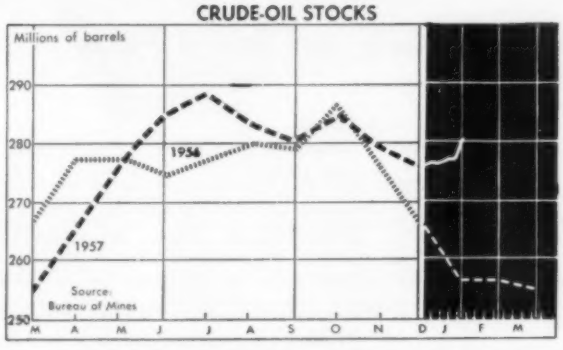
DAILY AVERAGE PRODUCTION FOR WEEK

	February 8, 1958			Feb. 1
	Crude oil	Lease condensate	Total	total
Alabama	15,400	.....	15,400	15,325
Arkansas	83,425	200	83,625	83,500
California	909,500	.....	909,500	908,500
Colorado	139,600	.....	139,600	139,250
Eastern	50,600	.....	50,600	51,000
Florida	1,275	.....	1,275	1,275
Illinois	235,100	.....	235,100	234,200
Indiana	31,600	.....	31,600	31,900
Kansas	†341,750	.....	†341,750	†328,050
Kentucky	40,800	.....	40,800	41,300
Louisiana	759,900	95,700	855,600	846,250
North	110,100	2,400	112,500	114,700
South	649,800	93,300	743,100	731,550
Michigan	25,300	.....	25,300	25,800
Mississippi	98,900	4,950	103,850	105,400
Montana	74,900	.....	74,900	74,450
Nebraska	54,650	.....	54,650	54,800
Nevada	150	.....	150	150
New Mexico	259,100	5,900	265,000	270,100
North Dakota	41,800	.....	41,800	35,850
Oklahoma	†562,800	.....	†562,800	†544,100
Texas	2,660,000	62,150	2,722,150	2,725,100
Dist. 1	48,000	475	48,475	46,550
Dist. 2	122,000	9,125	131,125	128,400
Dist. 3	371,000	31,000	402,000	410,000
Dist. 4	199,000	7,500	206,500	203,400
Dist. 5	35,000	500	35,500	32,500
Dist. 6	122,000	7,000	129,000	124,000
East Texas field	164,000	.....	164,000	161,000
Dist. 7-B	148,000	150	148,150	146,150
Dist. 7-C	143,000	3,650	146,650	151,075
Dist. 8	1,000,000	1,500	1,001,500	1,018,650
Dist. 9	201,000	600	201,600	198,725
Dist. 10	107,000	650	107,650	104,600
Utah	16,850	.....	16,850	18,225
Wyoming	308,500	.....	308,500	300,150
Others	‡200	.....	‡200	‡200
Total U. S.	6,712,100	168,900	**6,881,000**	6,834,875
Change from previous week, up			**46,125**	
Canada	†445,400	.....	†445,400	†529,800

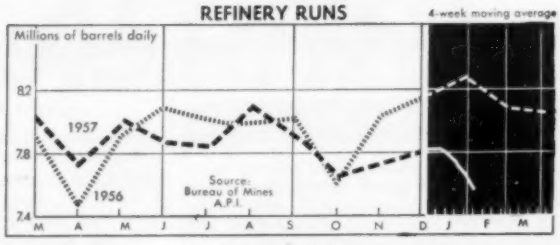
Total U. S. production, January 1-February 8 .. 268,458,340 bbl.
Same period last year (crude plus cond.) ..... *292,832,760 bbl.

*Includes 5,736,250 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

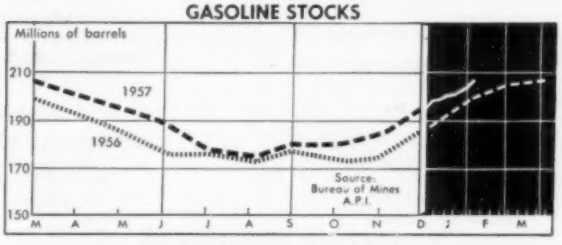
CRUDE-OIL STOCKS



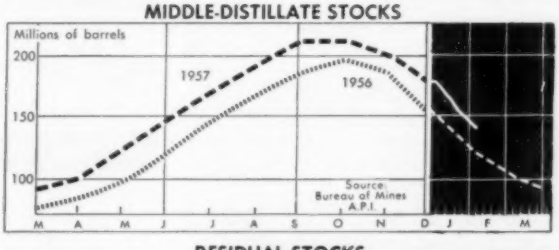
REFINERY RUNS



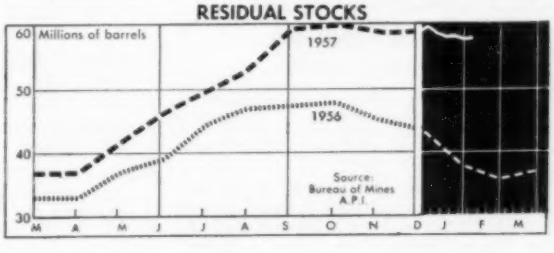
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-1-58	1-25-58	2-2-57
Pennsylvania Grade	2,941	2,905	2,362
Other Appalachian	1,621	1,631	2,258
Illinois, Indiana, and Michigan	11,354	11,038	10,123
Nebraska and North Dakota	2,400	2,754	2,186
Kansas	10,120	10,032	9,677
Oklahoma	19,675	19,025	21,428
Arkansas	2,549	2,519	2,915
Louisiana	20,070	19,465	18,777
North	3,275	3,035	2,849
South	16,795	16,430	15,928
Mississippi, Ala., and Fla.	2,631	2,429	2,688
New Mexico	9,564	9,162	7,954
Texas	121,999	121,914	111,966
East Texas	8,954	9,074	9,235
West Texas	53,059	53,987	52,701
Texas Gulf	25,983	24,987	21,575
Other Texas	34,003	33,866	28,455
Wyoming	14,127	13,812	16,261
Other Rocky Mountain	6,607	6,494	5,983
California	36,970	37,074	27,484
Foreign *	†18,593	16,628	11,929
Total	281,221	276,882	253,991

*Bureau of Mines. †Includes 5,948,000 bbl. in California.

API REFINERY REPORT—FEBRUARY 7, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1957—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,118	493.3	41.7	343.7	195.9	43,103	9,287	44,626	11,742	1,176	479.2	39.9	333.5	212.6
Appalachian:														
District 1	104	42.3	4.9	27.0	9.9	5,432	518	2,455	607	100	39.3	6.1	24.2	8.0
District 2	106	50.3	8.1	17.6	14.7	2,758	304	818	467	111	56.9	7.1	21.7	16.6
Ind., Ill., Ky.	1,349	691.3	65.6	326.1	166.0	37,037	4,625	15,698	4,804	1,466	706.1	71.3	340.2	209.8
Minn., Wis., Dak.	107	48.7	4.0	28.7	11.7	7,331	831	5,862	476	103	50.5	6.3	27.0	12.0
Okla., Kans., Mo.	719	394.4	14.3	172.2	37.1	19,580	854	9,060	1,227	689	379.9	15.0	172.5	44.8
Inland Texas	262	201.2	5.7	56.1	23.0	8,869	368	1,390	2,121	270	186.5	7.9	51.7	23.0
Texas Gulf Coast	1,600	837.1	152.4	404.3	178.2	30,055	2,029	12,172	5,728	1,945	879.9	121.5	580.5	242.6
La. Gulf Coast	569	333.7	47.6	130.2	44.4	13,097	1,364	5,694	1,132	685	329.5	62.0	207.2	52.7
N. La. and Ark.	78	31.9	6.7	16.3	9.4	5,073	750	1,905	82	96	37.1	7.3	25.9	7.0
Rocky Mountain:														
New Mexico	29	14.7	1.0	7.1	3.6	371	22	138	87	28	14.3	0.5	5.2	3.5
Other Rocky Mt.	273	129.1	5.4	60.1	34.1	7,128	291	2,659	903	286	135.1	2.5	68.4	42.3
West Coast	1,011	453.0	12.2	131.3	333.6	28,209	337	15,075	28,251	1,133	494.6	5.2	176.6	394.6
Feb. 7, 1958	7,325	3,721.0	369.6	1,720.7	1,061.6	208,043	21,580	117,552	57,627	8,088	3,788.9	352.6	2,034.6	1,269.5
Jan. 31, 1958	7,548	3,862.9	355.1	1,791.9	1,071.0	204,559	23,179	123,121	57,502	.....	.....	.....	.....	.....
Feb. 8, 1957	8,119	3,912.3	373.3	2,012.3	1,270.6	199,895	23,614	93,516	37,042	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	11.25-11.75
Premium (98 octane)	14.00-14.50

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	10.00-10.50
Regular (92 octane)	10.25-10.50
Premium (97 octane)	11.75-12.00
Premium (98 octane)	12.00-12.50

California (rack) (Los Angeles):

Regular (88 octane)	12.2
Premium (96 octane)	14.5
Premium (98 octane)	15.0

Caribbean area (cargoes):

★ Regular (87 octane)	9.875
★ Premium (93 octane)	10.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	9.50-9.75
Diesel oil (58 d.i. and above)	9.125-9.50
Distillate No. 1	9.125-9.50
Distillate No. 2	8.50-8.75

Gulf Coast (cargoes):

Kerosine 41-43	8.50-8.75
Distillate No. 2	8.25-8.50

New York Harbor (barges):

Kerosine 41-43	10.35
★ Distillate No. 2	9.65-9.85
Diesel fuel, 48-52 d.i.	10.25

Caribbean area (cargoes):

★ Distillate No. 2	8.50

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank cars	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3): Residual fuel (max. 1% S)	$1.25-1.40
Gulf Coast (cargoes): Bunker C fuel	$2.25-2.50
New York Harbor (barges): Bunker C fuel	$2.75
Caribbean (cargoes): Bunker C	$2.35
California (rack): Bunker C fuel, Los Angeles	$2.65-2.80

LUBRICATING OILS

Mid-Continent (Group 3): 150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade: 145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180° at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour) (§)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.81
16-16.9	2.74	....	....	....	1.86
17-17.9	2.78	....	....	....	1.91
18-18.9	2.82	....	....	....	1.96
19-19.9	2.85	....	....	....	2.01
20-20.9	2.89	$2.75	....	$2.62	2.06
21-21.9	2.93	2.77	....	2.64	2.11
22-22.9	2.97	2.79	....	2.66	2.16
23-23.9	3.01	2.81	$3.44	2.68	2.21
24-24.9	3.05	2.83	3.46	2.70	2.26
25-25.9	3.09	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour. §Most buyers are posting Wyoming sour in two schedules, 15°-26.9° and 27°-40°.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, July 26, 1957.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.65
Middle District	4.47
Southwest Pennsylvania	4.18
West Virginia	4.00
Buckeye Grade	4.00
Zanesville Grade	3.04
★ **Illinois Basin**	3.00
Canada:	
Leduc-Woodbend	2.74
Redwater (Aita.)	2.63
Smiley (Sask.)	2.40
Pembina	2.61

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
★ Lagunillas heavy, flat, Amuay or Las Piedras*	2.25-2.38
★ Bachaquero, flat, Las Piedras*	2.03-2.18

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
★ Arabian, 36.0°-36.9°, Sidon	2.49-2.59
★ Iraq, 36.0°-36.9°, Tripoli, Banias	2.49-2.59
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON
(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC—7.5%)	$2.64
Carib.-U.S.N.H., dirty (USMC —55.0%)	1.22
Carib.-U.K., clean (Scale—27.5%) (23s. 7d.)	3.30
P.G.-U.S.N.H., dirty (USMC—70.0%)	3.81
Sidon-U.S.N.H., dirty (USMC —72.5%)	2.15

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MAYHEW SHOT HOLE Drill and Drill Tender. Good condition. Sacrifice. Tom Purcell, 2220 Adolphus Tower, Dallas, Texas. RI 2-4257.

CABLE TOOL RIG, 28L Bucyrus, less than one year old. Tools from 12½" to 5", Swabs, Packers, 3" Mud pump, Dog house, light plant and Two 1956 Chevrolet Trucks, priced to sell. Ph. RI 2-0453. Address 4216 South Oswego, Tulsa, Oklahoma.

FOR SALE—Trailer mounted rotary Drilling Rig. 65 ft. jackknife derrick, 5 x 10 Gardner pump. 2850 ft. drill stem. Complete in every detail including International truck and float trailer. $21,000 cash. Contact W. H. Shaw, 1200 Oden St., Longview, Texas. PLaza 8-5096.

WELL SERVICE Company Equipment: 2—C34 Walker-Neer Spudders with finger boards (Purchased March 1956 and September 1956). All lines (7000') replaced last quarter 1957. These units may be inspected in operation. Also 1 complete Franks-44 unit, 1 RL Cardwell drawworks and mast. Contact Ross Maddux, Ph.: 4599, Shawnee, Oklahoma.

U-34 DRAWWORKS Serial #68 with WAK engine Serial #732489 and Torque Converter Serial #90642. Price $15,000.00. 127' Lee C. Moore Mast Serial #T-797 with 5½' x 34' substructure and 16" sub-base, extension braces, etc. Price $11,600.00. All located near Tulsa. Box K-524, The Oil and Gas Journal, Tulsa, Oklahoma.

HORTONSPHEROID TANK

1—5000 Bbl., Diameter 41'2", Height 32'11⅜", 20 p.s.i., suitable storage natural gasoline having RVP of 26 p.s.i. Erected new 1946 by Chicago Bridge & Iron. Excellent condition. Detail specifications available.

Located—Lance Creek, Wyoming

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CASING COUPLINGS:—51 pcs. 13⅜" OD x 8 Rd. thd. x 8" long, for sale. Never in use. JULIUS M. FOGELMAN, Reading, Penna.

1 36L BUCYRUS Spudder complete with 5 and 7 inch tailing in tools. Dog house, butane tank, junk rack and light plant. Rod and tubing tools and hand tools. Phone Office 144, Res. 614, Cleveland, Oklahoma.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

FAILING—Rotary Rig—Capacity 2500 Ft. 2900 Ft. 2⅞ in. x 30 ft. drill pipe, top grade, with new tool joints. Gardner-Denver Pump 5 x 10 skid-mounted. 3—30 ft. drill collars. Hughes core barrel. This rig too large for our needs. Price $20,000. Would consider top grade 1500 ft. at actual value—balance—cash. Hobert Betz—Lane, Kansas—Phone 39.

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9—300 H.P. Ingersoll-Rand, Model 8-XVG Gas Engine Compressors, 350 R.P.M. w/Compressor Cylinders sizes 3¼" to 19½" x 12".

Used, Good Condition.

Priced attractively. Prompt shipment from Lance Creek, Wyoming.

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Phone LUther 3-5516
Tulsa, Oklahoma

FOR SALE EQUIPMENT

USED FAILING 2500 Holemaster. Ideal for production drilling, deep exploration or water wells. IHC KB-8 tandem truck. 52 foot mast. 5 x 8 Gardner-Denver pump. Contact Sales Department, Geo. E. Failing Company, Enid, Oklahoma.

OILFIELD TANK BATTERY. Two Storage Tanks. 500 bbl. each. One Gun Barrel, 300 bbl. Clinton Iron and Metal Co., 7615 North Loop, Houston, Texas. Telephone OR 2-0503.

WELL DRILLS - CORE DRILLS. Everything for well and core drilling in both new and used equipment, at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

1 GMC PERFORATING TRUCK, complete with Gamma Ray logging equipment. 20,000' line capacity. Perfect condition. Will sell with or without logging equipment and line. Box K-487, The Oil and Gas Journal, Tulsa, Oklahoma.

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Submergible Tank Barge, 48' x 60' x 5' fresh water filling system barge with 48' x 48' x 13'—4-compartment 5000 bbl. oil storage, 500# W.P. Two stage separation, gas metering equipment—12 well header submerging equipment, cathodic protected—good condition.

Located: Berwick, Louisiana
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14' x 21' x 1" Shell, Steel
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8½' x 19' x ¼" Shell, T-31655
14" x 40' Tower, 160#
18" x 23' Tower, 160#
24" x 28' Tower, 550#

8' x 75', 28 Tray, 25#
5' x 96', 40 Tray, 135#
24" x 45', 24 Tray
18" x 32', 15 Tray, 180#
12" x 27', 20 Tray, 450#
24" x 42', 22 Tray, 230# T-30455
18" x 23', 11 Tray, 200# T-31655
30" x 20', 8 Tray 50# T-30455

Valves: Steel & SS ½" through 6"
Furnaces: Petro-Chem, ½, ¾ mil. BTU-HR.

HEAT EXCHANGERS

Steel Tube: 1000, 900, 650, 500, 300, 200 sq. ft.
Adm. Tube: 2250, 2200, 1300, 980, 740, 625, 300 sq. ft.
S.S. Tube: 1228, 947, 570, 536, 380, 315, 250, 157 sq. ft.
4-6% Chr. Tube: 1000, 500 sq. ft.
Fin Tube: 73, 21, 11 sq. ft.

PUMPS

Hot-Oil: 324 gpm @ 4600'; 735 gpm @ 3100'; 400 gpm @ 2000'; 1270 gpm @ 400'.
Water: 10,500 gpm @ 135'

COMPRESSORS

Worth.: LTC-6, Gas Engine, 800 hp.
Penna.: 100 CFM @ 500#; 385 CFM @ 100#

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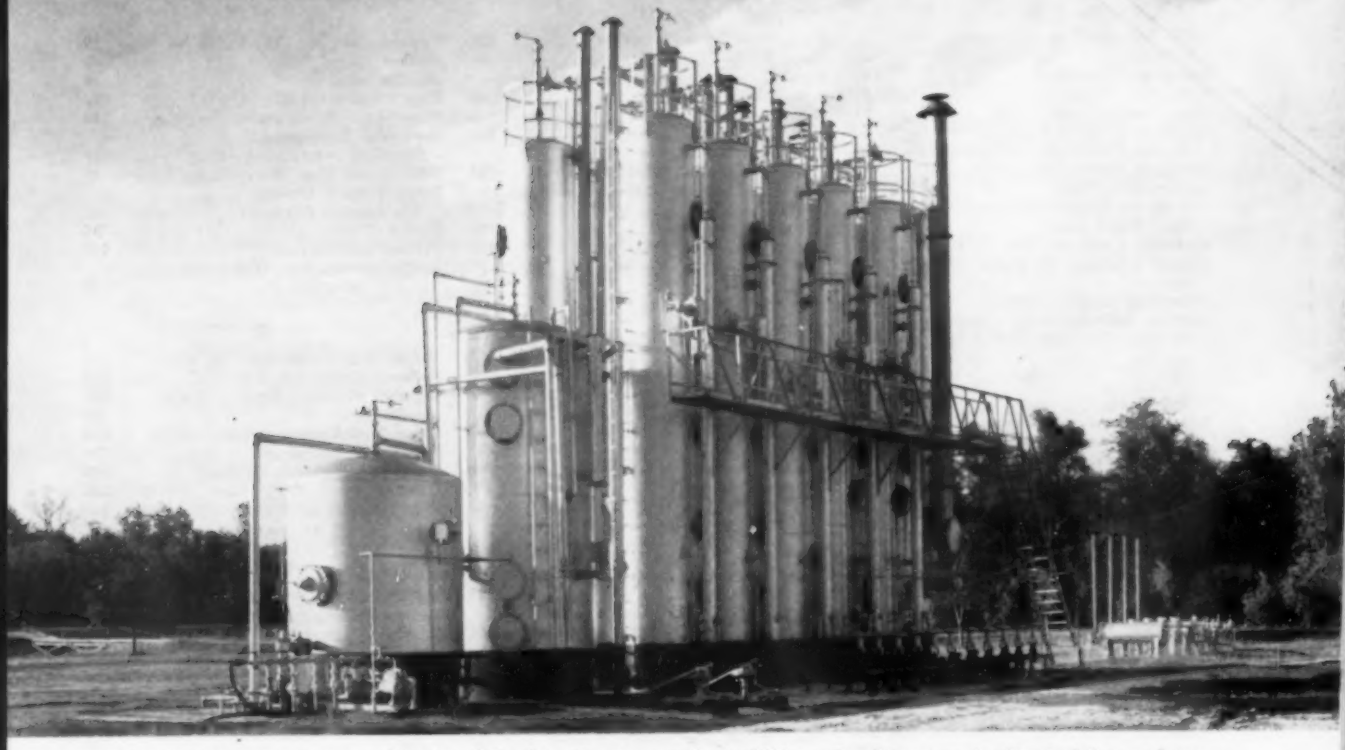
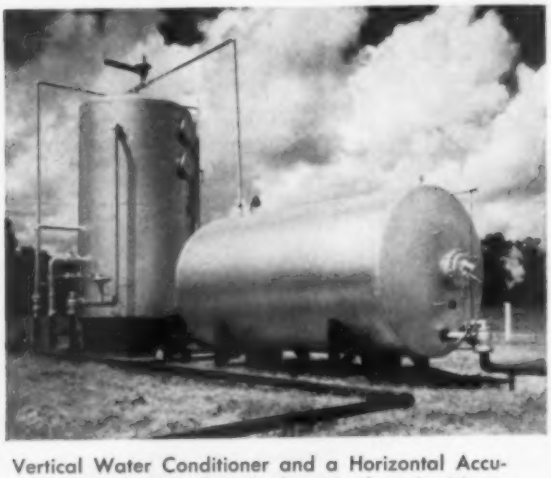
NATIONAL

CLOSED WATER DISPOSAL SYSTEM



Centralized treating battery of National Emulsion Treaters, a Vertical Water Conditioner and a Vertical Accumulator and Back Wash Tank in South Louisiana for a Major Oil Company.



Vertical Water Conditioner and a Horizontal Accumulator and Back Wash Tank in Northern Louisiana.

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